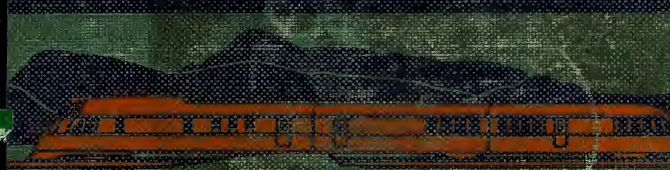


HOW WE HAVE
CONQUERED DISTANCE




WADDELL AND BUSH



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HOW WE HAVE CONQUERED DISTANCE



Photo by Charles P. Cushing

TRANSPORTATION TODAY

HOW WE HAVE CONQUERED DISTANCE

BY

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DEDICATED TO
NANCY W. AND HER FRIENDS WHO
READ THIS BOOK

TO THE TEACHER

How We Have Conquered Distance is a story of transportation and communication from earliest times to the present. This book is a companion book to *Long Ago* with the specific aim of providing interesting reading materials in the social sciences for the elementary grades.

The *Conclusions and Recommendations* of the Report of the Commission on the Social Studies asks for "a comprehensive body of literature and graphic matter for use in the schools from the first grade through the twelfth — particularly needful is the development of an extensive children's literature which will relate in fascinating detail and episode the story of the evolution of culture and man's adventure upon the earth — a literature which will describe the rise of industrial society and tell in language a child can understand of the achievements, the failures, the wonders, the tragedies, and potentialities of the modern world." (From *Conclusions and Recommendations* of the Committee on Social Studies of the American Historical Association, published by Charles Scribner's Sons, 1934.) The authors believe that they have contributed to this request of the Commission by the preparation of this book.

The social life of the people naturally falls into several functional phases or aspects of living. These aspects of living represent purposes about which the activities of current life tend to group themselves and are of significance in the lives of all people. These purposes of society do not change, but the means and agencies for achieving them do constantly change. Transportation and communication are functional purposes of society and do not change. The agencies of transportation and communication have changed in a comparatively short time. These stories show how these changes have taken place, and it is the hope of the authors that they will lead to the acquisition of accurate knowledge of, and an informed insight into, man and society.

Every effort has been made to appeal to the interests of the boys and girls of the lower grades. Throughout the book are many exercises under the heading of "Things to Think about and Do." These exercises are varied and provide a wide range of learning experiences. In the Appendix is a suggestive library reading list which can be used in building up a library for the social sciences in the grades and will help the teacher in providing reading experiences for the more gifted children. The vocabulary has been carefully checked, and except for needed unusual words is well within the range of the pupils for whom the book is intended.

The facts presented have been carefully investigated for their historic accuracy. The material in the book has been tried out with boys and girls in the grades for which it is intended and has proved to be within their comprehension. The authors trust that you will find this material useful in getting boys and girls to understand America as it was and is today — and perhaps tomorrow.

THE AUTHORS.

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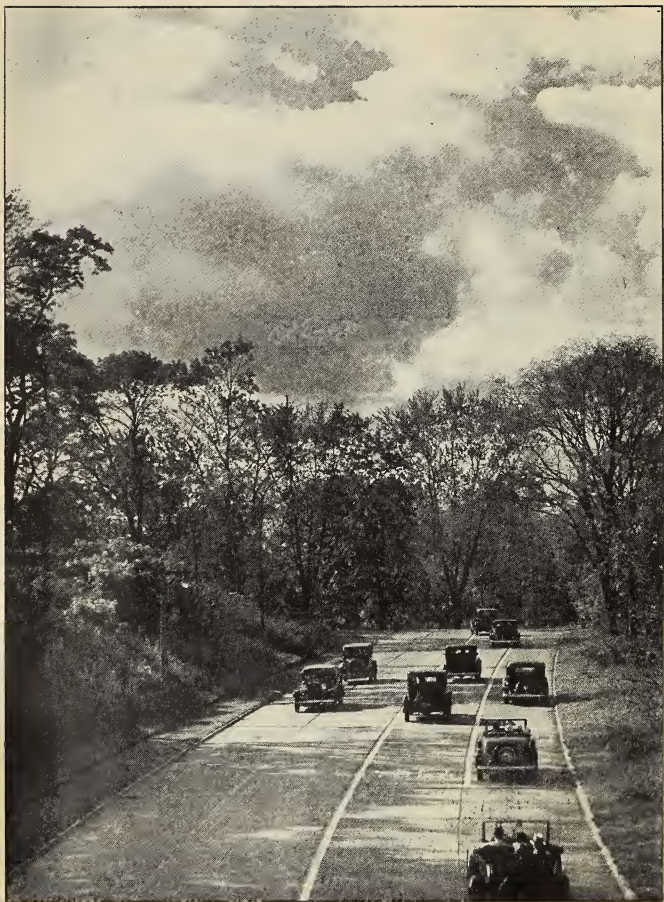


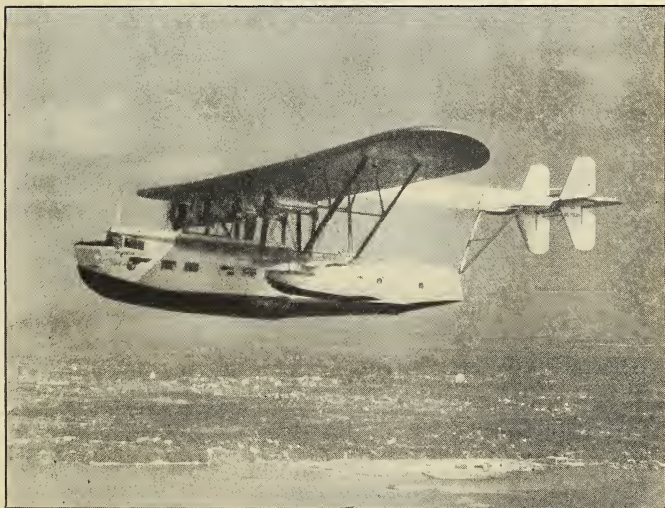
Photo from R. I. Nesmith and Associates

A MODERN HIGHWAY

UNIT ONE. TRANSPORTATION TODAY AND VERY LONG AGO

I. WHAT TRANSPORTATION IS

If we see a freight train standing on a sidetrack or a passenger train going along its way, we hardly notice either of them. This is because we have seen trains ever since we can remember. Boys and girls who live



Courtesy Pan American Airways

PAN AMERICAN CLIPPER SHIP OVER MIAMI, FLORIDA

near oceans or large lakes or rivers feel the same way about great ships that come and go.

There are also large auto trucks passing along our roads. Sometimes they get in the way of swifter automobiles that carry people quickly from one place to another. We hardly look at either of these except long enough to keep out of danger. We are so used to seeing them and hearing them that we do not stop to wonder about them or how they came to be here.

When, however, an airplane goes over our heads, we may look up and say, "There goes an airplane." Perhaps this is because not all of us have yet had a ride in an airplane but we hope some day that we may.

Another reason, no doubt, is that many grown-up people can remember the days before there were any airplanes seen in the sky and they will tell us how excited they were when they saw one for the first time.

A LEAD PENCIL AND TRANSPORTATION

Let us now think about something else for a little while. We all use lead pencils almost every day. Most lead pencils have three parts: lead, wood, and rubber. We wonder who has thought about the ways in which all the different parts of a lead pencil reached the pencil factory where they were put together and made ready for us to use.

Rubber trees grow in the very warm lands far away

in the south. Men cut slashes in the bark of the rubber trees. The thick white juice which drips out must be gathered in pails and carried by hand through the deep woods to the place where the *rubber milk*, as



Photo from Ewing Galloway

RUBBER IS CARRIED ON THIS AMAZON RIVER STEAMER.

it is called, is thickened into rubber. From here it must be carried again, usually by hand, to a river boat to be taken to the city from which it will go by steamer or train to the place where it is made into pencil erasers. From here it goes to the factory where it is put into the end of a lead pencil.

Another story just as interesting can be told about the "lead" in the pencil. This lead is really graphite. It was found in the ground and was carried to many different places to be mixed with a certain kind of clay. Then it was pressed into shape and finally was made ready for use in the pencil.

We can also tell about the cedar or other wood in the pencil that went from the tree to the sawmill and from the mill to the factory until finally it became part of a finished pencil.

If we think about the paint on the pencil and the tin that holds the eraser in place, we see that each part came from a different place in the world and was carried far in many different ways. We learn also that large numbers of people helped to carry the parts of the pencil from place to place. We also learn that some parts were carried on land and some on water before the pencil was ready for sale in the store where we bought it.

If lead pencils are made up of parts coming from far-away places and if these materials are carried long distances over land and water, what can be said of hundreds of other things that we use every day? What about much of our food, many things in our homes, and the things we wear?

Have you guessed by this time that we have been talking about the transportation of goods and of people?

The word is easy to remember because *porto* means "to carry." *Trans* means "across" and the whole word means the act of carrying things from one place to another.

We transport or carry things ourselves; we help others to do it; and we see transportation going on almost every time we are on a road or street. In fact, it is so necessary to give us our food, clothing, and shelter that we do not stop to think whether or not there ever was a time when there were no trains, no steamships, no wagons, no boats.

MORE TO THINK ABOUT AND DO

1. How many different ways of carrying goods are talked about in the story you have just read?

2. Draw pictures of other means of transportation you have seen.

3. Can you remember any other ways of carrying things that you have seen in pictures, either in books or at the movies? Can you draw some of them?

~~4~~ 4. Begin to look for and to save pictures and stories about any kind of transportation.

5. Ask your teacher to help you make a big, strong envelope in which to keep your pictures.

II. THE BEGINNINGS OF TRANSPORTATION

When you came to school today, you may have walked. You may have ridden a bicycle. Perhaps you had a ride in a car or in a wagon. If walking and

swimming were the only means of travel and transportation we had, how different our lives would be! It takes twenty minutes to walk about as far as a car goes in two minutes. Fifty pounds is a big load for a strong man to carry when he walks. A man could carry that load only a few miles in a day.

It is easy to see that if all transportation were carried on by hand it would take months for things to go from one part of the country to another. Besides, only a few things could be sent that way. Many things would be so very heavy to carry; and many other things would spoil or be broken. Something else to remember is that very few things could be carried across the water because man could carry very little if he were swimming or wading.

Yet it is true that men, women, and little children lived long, long years ago who never even dreamed of traveling in any way except by walking. They knew of no way to carry things except in their hands.

HOW EARLY MAN LIVED

Perhaps it would be interesting to know a little more about how these early people lived, although no one can tell just exactly how things were done so long ago. There was no one then who could write about it; yet in some parts of the world we still find the very places where these early people lived. By looking at what is

left there we learn that very early man probably ate raw fish and meat, raw birds' eggs, wild fruits, roots, stems, and even bark. This was because for a long,



From Wells' "How the Present Came from the Past"

CAVE MEN AT WORK BEFORE THE ENTRANCE OF THEIR CAVE HOME

long time he was afraid of fire and ran away from it in terror. We can think of these early people as being like little children left alone in a big forest or on a grassy plain. They had nothing but their hands with which to work, and they had never seen anything but

the woods and fields near by. They were so afraid of animals that they probably first lived in trees. Later they lived in holes or caves in the ground; and after a long time they learned to bend branches of trees to the ground and make tents for summer.

Many years after this they found that stone would cut wood, and they made wooden homes warm enough for winter.

After they learned to use stone for hammers and sharp flint for knives, men could kill the dangerous animals, and they could take off their skins to make clothes for their families and for themselves. They used the meat for food. During this time, too, men had learned much from the birds and animals. They copied their ways of storing food for winter and they probably learned from them how to build their homes.

In spite of all he could do, however, early man was often so cold and at times so hungry that he tried first one way and then another to make himself more comfortable. This is the way he learned everything he knew.

He tried until he could use fire to keep warm and to cook meat. He also found how to make dishes out of clay and to weave coarse cloth out of grass and wool. Each of these discoveries helped him to become much happier than he had been before.

As time passed on, man also learned to carry large

loads on his back, to drag them on the ground, and to push them down hill. We believe too that he was beginning to ride on logs floating in the water and that he had watched water animals and fish so that he was learning more about traveling on water.

As there came to be more and more people in one place, food often became scarce, and it was necessary to move to other hunting grounds. Sometimes, also, tribes made war upon each other, and the weaker ones were driven away from their homes. Later, as man came to have weapons, tools, and clothing of his own, when he went to a new home, he must have had a way of carrying his goods with him.

EARLY MAN LEARNS TO TRADE

Man had also another reason for desiring better means of transportation. He had learned to trade goods with other tribes who made different things or had different kinds of food from that which he had. Through the years he had learned to use straps to fasten the huge burdens on his back so that his hands could be used in other ways. This was called the *pack*. We still use the word today. We wonder if you can even imagine how hard it was to carry things in this way or how tired the men and women were who went up and down hills or along hot sandy paths with these heavy loads tied on their backs. No wonder they needed to lean

on heavy sticks as they toiled along! We are told that on long trips the women carried the packs so that the men could be free to fight for them if necessary.

Here then was man's next great need. He must be



Photo by James Sawders from R. I. Nesmith and Associates

CENTRAL AMERICAN INDIANS STILL CARRY PACKS ON THEIR BACKS.

able to do more than follow narrow trails through the woods, with a pack on his back or even on his head, wade or swim across small streams under a heavy load, or carry his things around lakes and large rivers because he did not know how to cross them.

MORE TO THINK ABOUT AND DO

1. Read any of the following stories that are in your library or that your friends have and learn more about the early beginnings of travel and transportation:

The Cave Twins by Lucy Fitch Perkins — Houghton Mifflin Co.

The Early Cave Men by Katharine E. Dopp — Rand, McNally Co.

Ab, the Cave Man by W. L. Nida — A. Flanagan Co.

Fleetfoot, the Cave Boy by W. L. Nida — Laidlaw Co.

2. Be ready to tell your classmates other interesting things about these early peoples that you found in these books.

3. Model a man carrying his pack, using clay or soap.

4. Think of some other way of telling or showing how transportation began and ask permission to tell or show your class.

5. Have you ever seen anyone carrying a pack? Tell about it.

6. Write five sentences that tell the things in this story that you wish to remember.

III. HOW MAN IMPROVED CARRYING
BY HAND

Although early man looked longingly across the water and wished he knew what was on the other side, it was many years before he did more than float on logs very near the shore. He did, however, learn some-

thing very important about carrying goods long distances on land. Up to this time when things were to be moved each person had struggled along by himself with his heavy pack tied to his back or carried on top of his head.

In some way early man found that he could tie his freshly killed animal to a strong pole and two men with the pole between them resting on their shoulders could carry a much heavier load more easily than when each worked alone.

THE LITTER, PALANQUIN, AND SEDAN CHAIR

You can see from this how early man learned that he could carry any pack on a long pole if he had some one to help him. This also probably helped man to find a much easier way of travel for anyone to whom the tribe wished to be very kind. Skins were stretched between two poles and fastened firmly. The person to be carried lay down upon the *litter*, as it was called. Men lifted the poles to their shoulders and walked along carrying their chief or some other leader whom the tribe needed and whom they hoped they could keep alive a long time.

For many years men carried the people whom they wished to honor in this way. They also carried goods on litters from place to place on longer and longer journeys as tribes traded more and more with each other.

You perhaps will like to know that this litter that early man made was liked so much that hundreds of years afterwards when men were much wiser they still

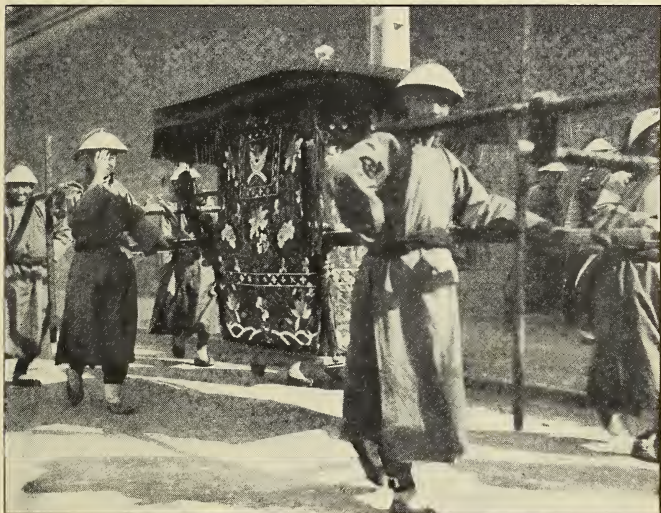


Photo from Ewing Galloway

THESE MEN ARE CARRYING A CHINESE BRIDE.

made use of them. They improved them, making them more comfortable and really very beautiful. They were built more like couches with sides and a top. Several men were needed to carry them. Rulers and other leaders thus rode in ease on the shoulders of other men.

These elegant covered beds were used by many different nations. They are called *palanquins* (pronounced pāl'ăn-kēnz').

Palanquins are still used in religious feasts. They also can be seen at times today in the Far East.



Photo from Ewing Galloway

A SEDAN CHAIR USED IN HONG KONG

The people of China even now have another way of carrying people through their narrow streets which is very much like the litter of early days. It is the sedan chair. This is a very slender chair inside of a cloth

box. The sides of the box have windowlike openings in them, and the front is usually open so that the one to be carried may back in and sit in the cushioned chair. Two long poles slip through rings on the sides of the sedan chair. These are raised to the shoulders of the carriers who run through the crowded streets of the city or along the hillsides transporting men or women where they wish to go.

We have now seen that early man after trying over and over to find better means of transportation on land learned how to make the litter. In doing this he took a long step forward, but he still used his own strength to bear the load that he wished to move from one place to another.

MORE TO THINK ABOUT AND DO

1. Here are some sentences that you can probably finish as you read them. Do not write in this book.

When earliest man wished to travel, he had to

_____.

He carried his goods in a _____ on his back.

He used a _____ to help himself along.

Then he found it easier to carry a burden on a long _____.

From this plan he got the idea for making a _____.

He used this to carry people and to transport _____.

Early man used his own _____ to bear his burdens.

2. Play that you are watching a tribe of early men on their way to a new home. Tell us what you see.

3. Make or draw one or more of the following: litter, palanquin, sedan chair.

4. Choose something else to do that your classmates will enjoy.

5. Write at least twelve sentences like those given above. Try to have them tell a story.

UNIT TWO. HOW MAN FOUND OTHER BURDEN BEARERS

I. THE FIRST BOATS

We have read how man began with only his bare hands to provide food, clothing, and a home for him-



From Wells' "How the Present Came from the Past"

CAVE MAN ARTIST PAINTING BY LAMPLIGHT

self and his family. We have seen how he learned to use the things about him to make life safer and more pleasant. That is, man discovered that nature would work for him if he could find ways to use nature.

Perhaps we shall understand this better if we think about how man learned to use fire. At first, you remember, he ran away from fire. Then he began to stay nearer to it. Later he put it where he wanted it, and used it to cook food, to keep him warm, or to give him light. He also learned to keep fire from day to day to use when he needed it. This was early man's greatest discovery.

In much the same way early man learned to use water to help him with the hardest of his work. You know that this was the carrying of heavy loads on long journeys.

THE RAFT

Soon after people learned that logs would hold them up on the water, some one wiser than the others tried the plan of chopping a log flat on one side. He tied another flattened log by the side of this one and made a *raft*. On this he could float his goods and his little children as he swam beside the raft and pushed it along.

Others made larger rafts. They stood upon these and pushed them ahead with long poles. Now water

instead of man himself bore the heavy load. He had found an easier way of moving goods by having water work for him.



Photo from Brown Bros.

PASSENGER RAFTS ARE STILL USED ON THE ISAR RIVER
IN GERMANY.

THE DUGOUT

In other parts of the world at about the same time other men had seen logs floating upon the water. Instead of thinking and trying until they made rafts, these early thinkers tried another plan. They flattened the logs on one side. Then with their sharp stone axes they dug out the wood until the log was

hollow. Sometimes they burned out the inside of the log with fire. Then they and their goods could ride inside. Thus the first boats, called *dugouts*, were made.

Next, man must find a way to move the dugout in very deep water. By trying over and over men had



Photo from Brown Bros.

AN AUSTRALIAN DUGOUT

found that they could push against the water with their hands and move their boats along. This helped them to see that longer arms and bigger hands would be much better. These they made from wood. The first paddle was thus made or invented. Some people

fastened their paddles to the sides of their boats or rafts. Then *oars* had been invented.

BETTER BOATS AND RAFTS

Even though early peoples traded with other tribes that lived several days' journey away, yet the world



Photo from Ewing Galloway

ESKIMO WOMEN HUNTERS IN THEIR KAYAK MADE OF SEALSKIN
OVER A LIGHT FRAMEWORK

is so large that in those days men did not even know that there were other peoples whom they had never seen. This is because wide oceans and high mountains

kept even the bravest persons from traveling very far. So in some places men made dugouts; in others they built log rafts; and in still other lands they made small boats of birch bark like those of the American Indians. Bark boats were made water-tight by putting pitch from pine trees in all the cracks and seams.

Other men used the skins of animals to help them ride upon the water. Raw skins were stretched over light wooden frames. As the skins dried, they made light water-tight boats.

Early man did something else that shows how carefully he studied nature and learned from nature's ways. With bone needles he sewed up the skins of animals until they were air-tight and could be blown up like balloons. He tied several balloons together to make a raft. Other people used skin balloons under their wooden rafts so that the rafts could carry heavier loads. Can you tell why?

Nature taught man another wonderful lesson. He felt the wind blow against him. It pushed trees this way and that way. Sometimes it blew his house down. Some man thought about this until he tried holding a big skin up against the wind as he stood on his raft. The wind blew against the skin and this pushed the raft along. This was much better than rowing with oars, because man tied the skin to a tall pole and the wind did all of the work.

Man has done many things to improve boats since the first ones were made. We shall learn about this later on. The most wonderful part of transportation by water perhaps has not happened yet. We must remember that men and women today are still learning better and better ways of using the things that nature provides for us.

MORE TO THINK ABOUT AND DO

1. A book called *The World We Live in and How It Came to Be* by Gertrude Hartman — The Macmillan Company, is perhaps in your library. Please ask your teacher or some older pupil to read Chapter III, "The First Boats," to you.

2. If you have a sand table or a place on the floor, would you like to use it to tell the story of the first boats?

3. Play that you are living way back in the days that we have read about. Tell about your food; your clothes; your home; the games you play with other children.

4. Bring to school anything that you are allowed to take that is like the things early man used. Perhaps you can start a museum in your school.

5. Probably your geography tells about *keleks* and *koofahs*. What are they?

6. Write ten sentences that tell the differences between the boats men made in early days.

II. ANIMALS AS BURDEN BEARERS

At about the time that the long-ago people were making their first boats, they were also learning that not all the wild animals were to be feared. No one knows how the first animals were tamed. Perhaps baby animals were brought home to the children for pets. Perhaps man learned to catch animals in big holes in the ground and feed them there until they became friendly.

The dog was one of the first animals to be tamed, and man used the dog to help him hunt other animals. Wild goats, sheep, horses, and cows were finally caught and kept in herds. They furnished milk and meat.

HOW TAMED ANIMALS HELPED TO TRANSPORT GOODS

Man found how strong cattle were; so he tied the pack that he had carried on to the back of the tame ox and the yak. Horses were smaller then than they are today, but man made them carry big packs on their backs while he walked beside them. Donkeys, though smaller than horses, were strong and sure-footed. Since the earliest days they have been carrying heavy loads for men in many different countries. The camel, the llama, and the elephant are also burden bearers for man.

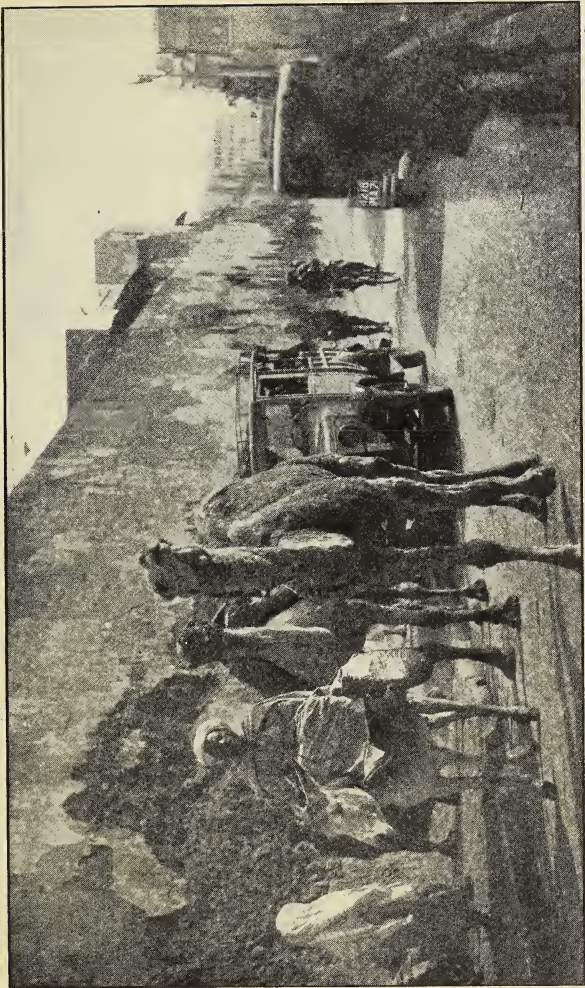


Photo from Brown Bros.

ANCIENT AND MODERN MEANS OF TRANSPORTATION ARE FOUND SIDE BY SIDE ON THE STREETS OF MOROCCO
IN AFRICA.

From these early, or primitive, times till now animals have been used to carry loads upon their backs in places where things could not be moved in other ways.



Photo from Ewing Galloway

HUSKIES ARE STILL BURDEN BEARERS IN THE FROZEN NORTH.
AIRPLANES ARE ALSO USED HERE.

Primitive man, however, was not satisfied even with these ways of transporting goods on land. He discovered that logs and other things slipped easily over the snow. He then put his loads on flat sleds and made a harness out of leather to fit his dogs. They learned to draw the loads. Even today strong, faith-

ful dogs draw loads and people in the lands of ice and snow. Reindeer also are used in this way in several countries of the Far North.

In early days the flat sleds were later on rounded at the ends. These sledges were used in summer also. Cattle or other animals drew them, but they were very hard to pull. Can you tell why?

Primitive men also invented a still different way of using animals to transport goods. They fastened the poles of one end of a sort of litter to the sides of the leather saddle of a horse. They tied their goods to the litter and rode the horse while the other ends of the poles dragged on the ground. This was called a *drag*.

You can easily see that the drag would not carry a load very safely unless the ground were smooth. We have reason to believe that the drag was used only on old trails or on quite smooth land.

We are told that in some lands the litter was hung between two horses, the poles running along the horses' sides. How would you like to have a ride in such a conveyance?

You have learned now that man really learned to shift the burden from his own back to the backs of animals, to the sledge or the drag, and to the boat or raft. What wonderful lessons man learned by thinking and trying new and better ways of doing his work!

MORE TO THINK ABOUT AND DO

1. Would you like to begin to make a set of large pictures that will tell the story of transportation in order from the very beginnings? Perhaps you will decide to use wax crayons so that all your pictures will look well together.

2. You may wish to write the parts of the story that the pictures do not tell. If you do this, you will have something that you will like to show to other classes or schools.

3. Read *From Hunters to Herdsmen* by Elizabeth O'Hara — The Macmillan Company, if you can get the book.

4. How do you think man learned to ride on the backs of animals?

5. Choose something else to make or do that will help you remember this story.

6. What can you find out about a pack train? About a howdah?

UNIT THREE. EARLY MAN'S GREATEST INVENTION

I. THE WHEEL

All the things about which we have been reading happened a long time ago. No one can tell exactly which of the primitive peoples first learned a way of moving things that were too heavy for even animals to drag on the wooden sledges in summer when the ground was without snow.

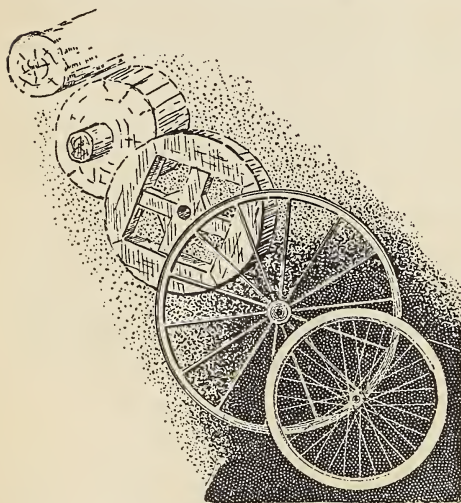
There are stories which tell us that these people had learned to build with stone. They used larger and larger stones until finally they wanted to use stones heavier than they could move by any means they knew.

HOW THE FIRST WHEELS WERE MADE

As we have said before, some of the people were always trying to find new and better ways of using the things that they found in nature. At last, perhaps some one watched a log rolling down a hill or stepped on a rolling stone, and it made him think of a new plan. So he put some small logs under a sledge on which was a huge stone. Men could pull the load

quite easily over the rolling logs. Of course, they always had to carry the logs from behind the sledge and lay them on the ground in front of it. They did not mind this so much, however, so long as they could move the stones.

We do not know how long men were contented with



these crude rollers. It may have been hundreds of years. At last some one of the thinkers, or it may have been some one of the workers, got the idea of a roller that did not have to be lifted and carried every time the load went a few

HOW THE WHEEL MAY HAVE DEVELOPED

feet. Probably while looking at the end of a log he grasped the idea of a roller that could turn on a fixed axle. Whoever he was, we should think of him as one of the world's greatest benefactors. He put man's burdens on *wheels*.

THE EARLY CARTS

No doubt the first wheels were made by slicing sections from a large tree trunk. The maker could cut or burn a round hole in the middle of each wheel and put the ends of a small strong log through these holes for an axle. By driving pieces of wood crossways through the outside ends of the small log to keep the wheels in place, man had the beginnings of the first two-wheeled cart. How it must have creaked and rattled! The wheels no doubt often broke, but how proud of it man must have been!

From pictures and from things remaining from these days we find that some men were not long satisfied with carts drawn by one animal. They wished to haul bigger loads, and so they needed to find a way to hitch two oxen or other animals to their carts.

The best thinkers found that they could fasten a long pole to the heavy axle. For some time they had had leather collars about the necks of their animals to which ropes were fastened for pulling loads.

Some one thought of making two strong wooden collars fastened together by a heavy crosspiece of wood. This crosspiece was fastened to the pole of the cart. The wood was carefully shaped so that it fitted the necks of the animals, and the *yoke* had been invented. So much did people like the yoke that they made yokes for their own shoulders so that they could

carry things by hanging them from each end of their yokes.

You will see both yokes and carts very much like these early ones still used in many places today. It



E. M. Newman from Publishers Photo Service

COSTA RICAN OXCART WITH HOMEMADE WHEELS AND YOKE

will be interesting to be on the lookout for these as you read and study how people all over the world live today.

As soon as men had invented carts, they needed wider trails and better ones, and so from this time on they spent thought and hard work on making smoother roads.

MORE TO THINK ABOUT AND DO

1. In what other ways do you think early man may have come to invent the wheel than those given in this story?

2. Find as many pictures as you can of early kinds of wheels for your picture collection.

3. If you like to work with wood, try to make some of the things talked about in this chapter.

4. The book, *Dan-Hur and the First Farmers*, tells a story about the first oxcart. This book is written by William L. Nida and published by the Laidlaw Company. Perhaps you can read this story beginning on page 170. You may wish to read the whole book.

5. Read again the story of THE WHEEL and make at least four questions that will help us to remember the important parts of the story.

6. Make a list of any new words used in this story that you think you would like to use yourself. Can you spell these words?

7. How do you think man made the first roads?

8. Are there any roads anywhere today like the early roads? Where are they?

II. MORE ABOUT WHEELS

We have read how early man learned to make animals help him as burden bearers and how the wheel helped them. We are now going to see how the wheel helped man in those places where he was or still is the burden bearer.

THE WHEELBARROW

One of the very early uses of the wheel was in the wheelbarrow. Some one took the idea of the litter and put a wheel between the poles at one end. With the load in the middle, man could partly carry and partly



Photo from Ewing Galloway

ONE FORM OF CHINESE WHEELBARROW WITH A SAIL

push a loaded wheelbarrow a long distance without being very tired. Try wheeling a wheelbarrow if some one will let you use one.

China is a very old country. Wheelbarrows have been in use there ever since the earliest days. The

Chinese wheelbarrow is different from ours of today. It has the wheel in the middle with the load on either side of it. This makes the wheel carry more of the load. Sometimes two people sit, one on each side of the wheel of a wheelbarrow, and one man can push them quite easily. Some Chinese put sails on their wheelbarrows. Can you tell why?

In a few countries far from our own, men and even women still draw or push heavily loaded two-wheel carts as they did in the long ago. This is usually because there are many people and few horses or other animals to use for this work. But pulling a cart is much easier than carrying a load in a pack on one's back as everyone did at first.

THE JINRIKISHA

Today in China or in Japan and in other countries, too, one can ride in a light two-wheeled cart drawn by a man. It is the *jinrikisha*. No one knows who its inventor was; it is much more like a large two-wheeled baby buggy than it is like anything else. Perhaps you may have a ride in one some day. Who knows?

We shall now see what differences the wheel made in the work that man could have animals do for him. No sooner had he invented the two-wheeled cart and found a way to have two animals draw it than he began to think of more ways to use this new helper.

At first he used it only for carrying heavy loads. He built different kinds of carts to fit different loads. He used slow strong animals which could pull large loads even though the roads were rough and hard to follow.



Photo by Burton Holmes from Ewing Galloway

A JAPANESE JINRIKISHA

By this time many tribes had grown large and powerful. They had rulers who led the people in wars against each other. The wheel was welcomed by these rulers for carrying supplies for the armies. Out of these wars came another invention. It was the chariot.

THE CHARIOTS OF LONG AGO

The chariot was made of wood. It was boxlike and open at the top and at the back. Early chariots were quite high, the box or body resting on a heavy axle



Courtesy The Metropolitan Museum of Art

A CHARIOT THAT WAS USED IN NORTHERN ITALY 600 YEARS
BEFORE CHRIST

between the wheels. To the long pole in front were fastened two or more swift horses. The warrior stood in the chariot. Often another person rode with him to drive. At other times one man both fought and drove. Sometimes sharp knives were fastened to the wheels and chariots then became terrible weapons of warfare.

For years and years chariots were also used for travel, for parades, for hunting, and for racing. Indeed, the chariots of rulers and rich people were beautifully made. Some were covered with gold and were richly carved and painted. They had jewel ornaments. They were finally made lower and the rider could easily step in or out from the back of the chariot.

There are pictures of chariots in many of the books written about olden times, and there is a real chariot in a museum in New York City. Learn more about chariots if you can.

THE CHAISE AND THE HANSOM CAB

In the early days of our own country people used another kind of two-wheeled cart. It was called a *chaise* or *shay*. It was drawn by a horse and had a folding top that could be lifted to keep out the sun or rain.

In Canada today we can see a two-wheeled cart much like this, except that it has also a seat for the driver. It is called a *calash*. Visitors to Canada like to ride in these carts.

A cab, or a hansom cab, is a two-wheeled, one-horse, covered cart with a seat for the driver high up on the back. These cabs are still seen on the streets of some cities.

Other kinds of two-wheeled carts are used today in

many countries of the world. Some are drawn by dogs; others by ponies or donkeys. In still other lands people use heavy two-wheeled carts drawn by larger animals as they did in the long ago.

It is true that the people who traded most with other countries or who made war against other peo-



Courtesy of Curtis and Cameron

“THE DEACON’S ONE HOSS SHAY”

(From a painting by Howard Pyle)

ples and copied their inventions learned faster in this way than those who worked everything out for themselves. It was not long before four-wheeled wagons

had been made. These were soon used in many countries for carrying heavy loads.

People, however, kept on improving the wagon by making lighter and stronger wheels. Some one thought of using the wagon to make a carriage for the ruler. This early carriage was most of all like a covered litter or a palanquin placed on four wheels. Instead of a bed inside it had a seat. It was padded with silk or leather and was beautifully painted. It had no springs and probably was very uncomfortable. It was drawn by four or more horses and the driver sat in front on a high seat on the outside.

CARRIAGES AND COACHES OF LONG AGO

When the first emperor went traveling in his grand carriage, it was thought to be a great wonder. Of course, other rulers tried to have even grander carriages. These cost a great deal of money, however, and for a long time only a few kings or other very rich people could have them.

These large carriages were very heavy, and often they sank in the mud or were unable to stay right-side-up on the rough roads. This taught the people the need for better and better roads. While some persons were thinking about making better carriages, others were building better roads.

Because the first carriages were so much admired,

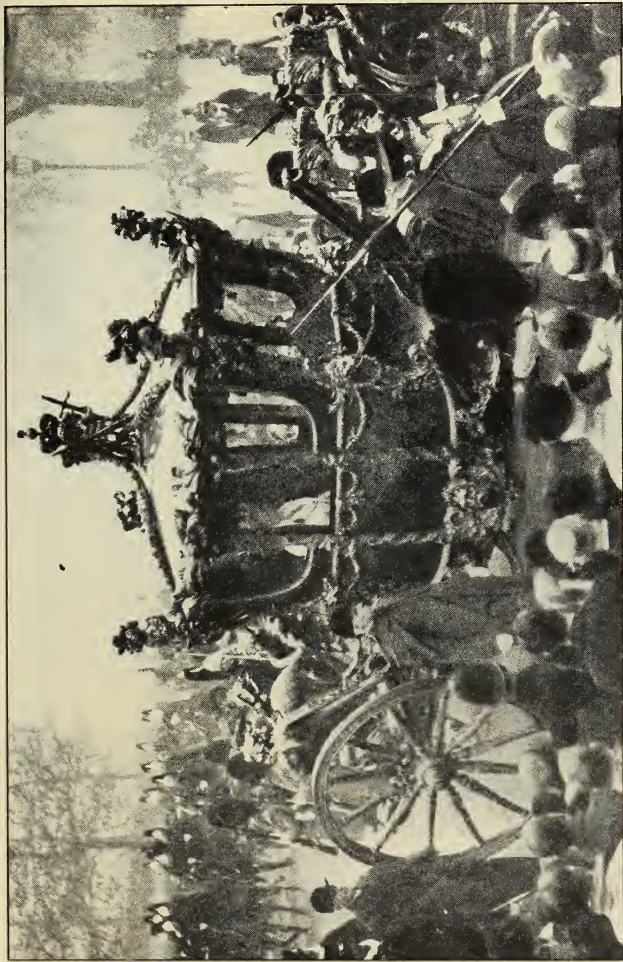


Photo from R. I. Nesmith and Associates

THE COACH IN WHICH THE ENGLISH KING AND QUEEN RIDE ON STATE OCCASIONS

some one tried to make them more comfortable. It was found that the body of the carriage could be hung on very wide, strong leather straps. This made riding over the rough places much easier. This carriage or coach was also first made for kings or other rulers and their families. It had two seats facing each other. There were doors at the sides. The very best artists worked upon the coaches, using gold paint, rich silk, and the best of leather. Often beautiful colored pictures were painted upon them.

Besides the driver there was usually at least one postilion. This was a man who rode the left horse in the first pair of horses. The postilion helped if the coach driver needed him. Can you think of some of the things that might happen?

After these very fine coaches had been used by rulers, other people began to build cheaper coaches. Many people owned them and used them for travel.

STAGECOACHES AND OTHER WAGONS

For those who did not have coaches of their own there were stagecoaches that made trips back and forth over the same road. It cost much more to travel then than now. The stagecoach could travel only three or four miles an hour and only in summer. Can you tell why?

For many years, in our country and in other coun-

tries, the stagecoach carried people, mail, and also small packages. Of course the coaches were made larger as time passed. They were later made with steel springs in place of leather bands. Seats were put



From a painting by Stanley M. Arthurs

A COLONIAL STAGECOACH

on top as well as inside. We must remember that, even though these coaches were drawn by four or six horses, they were often kept from going on their trips by floods, snow, or mud.

There are other kinds of wagons that have made those who had them very happy. Perhaps you have

heard grown-up people talk about a *buckboard*, a *buggy*, a *surrey*, a *phaëton*, or a *carryall*. These are names given to wagons that were drawn by one or two horses. They carried father, mother, and the children many a mile over roads that we today should think were too bad to be traveled at all.

From the earliest times transportation, when there is snow on the ground, has been by sled, sledge, or sleigh. Each country has had its own kind of sledge, but they have all been very much alike. Dog teams or stronger reindeer in the very cold lands draw the loads. In countries like ours horses are used. When it is icy, horses must have sharpened steel shoes on their feet to keep them from slipping.

MORE TO THINK ABOUT AND DO

Choose from these the things you like best to do and do these first.

1. Draw a Chinese wheelbarrow like the one described above and an American wheelbarrow. Be ready to tell how they are different.

2. Draw or make a jinrikisha.

3. Find a picture to help you and draw a chariot. Be able to tell how chariots were used.

4. Try to draw a calash or a hansom cab.

5. Draw a chaise with its top up.

6. Tell about the coaches built for kings. Ask some one to help you find a picture of one.

7. What were the greatest differences between the early coaches and the later ones?

8. Find something else in the story that you would like to tell about, draw, or make.

9. Ask some one to read "A Journey in a Jinrickisha" to you. It begins on page 46 in *How We Travel* by J. F. Chamberlain — The Macmillan Company.

10. Ask your teacher or some one else to tell you about the "covered wagons" that were used in our country about one hundred years ago.

11. *The Picture Book of Travel* by Berta and Elmer Hader — The Macmillan Company, will tell you many other interesting things.

UNIT FOUR. MAN USES THE WATERWAYS

I. BIGGER AND BETTER BOATS

We have followed man from his very early days to much later times as he discovered and invented ways to make travel on land easier and better. Now we are to go back again to the days when man had first tried to use a sail to help him travel on the water.

There were many things about the early rafts that man did not like. The waves washed over the logs and carried the goods upon them into the water. Animals and children fell off and perhaps were drowned.

THE BOATS OF OLDEN TIMES

So man thought and worked until he found ways to make rafts better helpers. First, he built sides around them. Still the water splashed over the load and wet it. Then, some one put a floor on top of the sides so that the load was above water. Some one else added a covering above this floor, or deck, and probably built a railing around it. Now the raft was greatly improved.

Several men were needed to row so large a raft. Sails helped when the wind blew the way the boat was going. Next, men saw that longer and narrower rafts with sloped-up ends were still easier to use.

These rafts were the beginnings of all of the flat-bottomed boats of today.

We have already read how very early peoples also made small, light boats of bark or of skin stretched over wooden frames. These boats were rounded on the bottom. Later, man made much larger frames. He tied or pegged strong, light pieces of wood to these frames. The pieces were cut to fit together so that the boat would be as nearly water-tight as possible. Pitch or something else that would keep out water was put into all the cracks that were left. Then a tall, straight pole or mast was set up in the middle to hold up the sail.

THE EGYPTIAN GALLEYS

Almost five thousand years ago in Egypt men had learned to build boats that took more than twenty oarsmen to row. These boats carried goods up and down the Nile River. Men used a sail to help if the wind was blowing the way that they wanted to go. They tried to make these boats beautiful as well as useful.

The Egyptians also built war boats called *galleys*. These galleys had large fierce-looking animal heads made of iron fastened on the fronts of the boats. These iron heads, we think, were used to break the boats of others whom the Egyptians were fighting.

Pictures of these boats were carved in stone and painted on walls by people who lived at that time. In this way we learn about them.



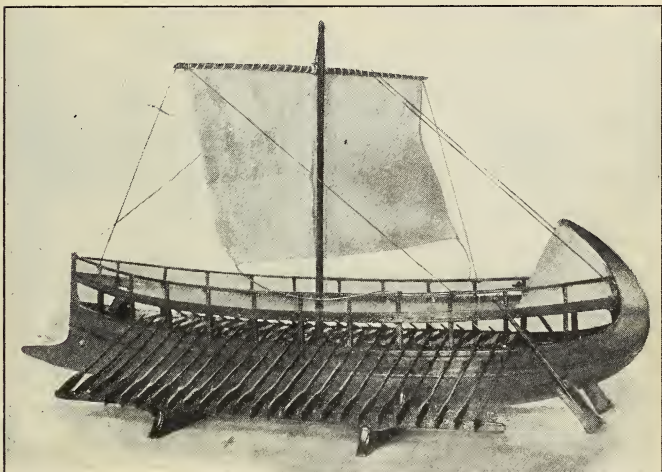
Courtesy The Metropolitan Museum of Art

A SHIP OF THE NILE AS PICTURED ON THE WALLS OF A KING'S
TOMB IN THEBES

THE PHOENICIAN SHIPS

The next important change in early boats was made by the Phoenicians. The Phoenicians lived not far from the Egyptians. Their home was near the sea. At first they were fishermen. Then they became great traders. They built their boats so large that they might be called ships. They had two rows and later three rows of oarsmen sitting one above the other. In this way they could carry heavy loads faster without building their boats too long. Why did they not want very long, narrow boats?

The Phoenicians not only transported goods for themselves to and from many lands, but they also carried goods for other countries. They were the greatest



Courtesy Philadelphia Commercial Museum

MODEL OF A PHOENICIAN SHIP USED 700 YEARS BEFORE CHRIST

travelers of their time. They also were the greatest shipbuilders. They finally built ships so large and strong that instead of having the rowers sit one above another, four or more men sat side by side and pulled on each long oar, or *sweep*, as it was called. The oarsmen in those days were usually slaves or prisoners. Sometimes they were chained to the seats while they were rowing.

EARLY GREEK AND ROMAN SHIPS

The Greeks and the Romans by this time had learned much from other countries. They had become strong nations. Often they made war on other peoples. These two peoples kept building larger, stronger, and swifter ships both for transportation of goods and for fighting. Their larger ships might carry more than one hundred rowers. Sometimes, we are told, many more than this number sat side by side in three or four rows, one above the other, pulling at the long sweeps. This they did for hours at a time. We cannot even imagine how tired these men must have been.

SHIPS OF THE VIKINGS

Far away to the north of the homes of the Egyptians, the Phoenicians, the Greeks, and the Romans lived another daring sea people. These were the vikings. They were fishermen, travelers, and robbers. People were afraid of the vikings. They were bold and daring. They learned early how to build boats that they could use even on the ocean. Their boats were not large but they were strong and sturdy. They usually carried from forty to sixty rowers.

The front and back of the viking boats came up to high points. On the front there was always a wooden carving. It might be the head of a dragon or of a

snake. The painted shields of the warriors were often hung on the sides of the boat.

Vikings and their ships are interesting to us because we are quite sure that they were the first people from another land to come across the ocean to our land. They came here, we think, before Columbus did.



Photo from Ewing Galloway

A VIKING SHIP
(From a model by Dwight Franklin)

MORE TO THINK ABOUT AND DO

1. There is much more to know about this part of the story of transportation than your book tells. Perhaps some one will read to you from the books given below. You will wish to ask many questions as the reading goes on.

Early Story of Mankind by Clark and Gordy — Charles Scribner's Sons.

"How the Egyptians Traveled," page 78.

"The Seafaring Phoenicians," page 111.

Egyptians of Long Ago by Mohr, Washburn, and Beaty — Rand, McNally and Co.

"With the Boatman on the Nile," page 55.

The World We Live in and How It Came to Be by Gertrude Hartman — The Macmillan Company.

"The Cradle Lands of Civilization," Chapter VI.

Pioneers of the Deep by Lila Gravatt — Mentzer, Bush, and Co.

"Vikings from the Cold North Land," page 20.

2. Write the names of the different kinds of boats you have read about. Ask your teacher or some one else to find pictures of them in the dictionary or in other books for you.

3. Make a list of all the words in this story that name:

- (a) the parts of a raft or boat
- (b) nations or peoples
- (c) what men did
- (d) where men went

4. Prepare five questions that will help you tell the whole story.

5. Are you saving pictures of transportation when you find them?

II. SAILING THE SEAS

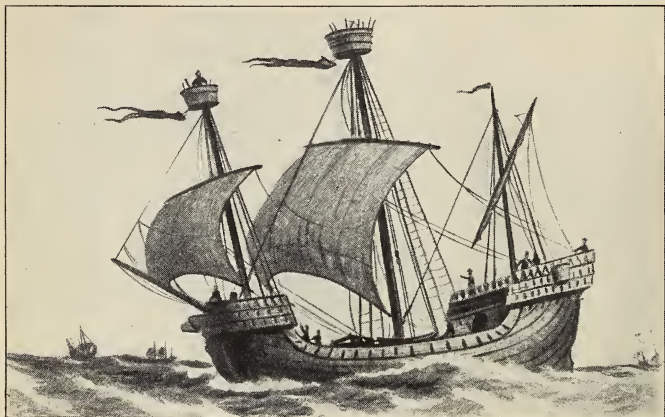
Man's helper, the wind, sometimes in the early days worked well for him. Sometimes it pushed his boat exactly the wrong way. Then man must take down his sail. The long rows of oarsmen must do all of the work needed to drive the boat along. Besides this, man could not tell ahead of time when the wind was going to blow the way he wished to go. Can you think of reasons why traders would not like this?

THE FIRST SAILS ON SHIPS

Soon, however, some one who was thinking and trying to make things better discovered a way to do it. He found that if the sails could be turned sideways they would catch the wind even if it was not blowing just the way the boat should go. It was not long before some one else tried using two sails. These caught more wind and by turning them the wind could be made to push the boat almost any way men wanted it to go.

More and more persons tried these new ideas. They learned much about sails from the countries with which

they traded. They tried many different kinds of sails. They placed them in many different ways upon one, two, three, or more masts. The making of swift,



Courtesy Philadelphia Commercial Museum

A SHIP IN USE ABOUT 100 YEARS BEFORE THE TIME OF COLUMBUS

strong sailing vessels became the pride of the trading nations.

As ships began to go faster and were built larger, men needed better ways of steering them than by paddles. The rudder and the steering wheel therefore came to be invented. Perhaps some day you can see a real rudder on a boat and turn it by using the steering wheel.

THE COMPASS AND ASTROLABE HELP THE SAILORS

The invention of the compass at about this time did more than any other one thing to help traders transport goods. You will need to see a compass or a picture of one really to understand how it works.



A MARINER'S COMPASS AND AN ASTROLABE

Before sailors had compasses, often they had no way of telling which way they were going when they were out of sight of land. Why was this? It is true that early traders had learned to guide their ships by the stars. Why was not this way so good as having a compass?

About the time that the compass was invented, sailors had learned to use the astrolabe. With this they could find what time it was from the position of

the sun, moon, and stars. They could also find out where on the great ocean they were at any time. They wrote their exact position on the ocean and the time when they were there in a book called a *log book*. Then they could sail the same way again if they wished to do so. Today something like the astrolabe is still used to find the exact position of a ship. It is called a *sextant*.

By this time it is easy to understand what great changes came when ships could be driven along by the wind, no matter which way it was blowing. Can you tell what one of these changes was?

If you think too of the new way of steering and of the help given by the compass, you can see that transportation by water had now become the easiest and cheapest way to send goods from place to place.

EXPLORERS AND THEIR SHIPS

As the years passed, other nations had grown stronger than the Greeks and the Romans were. These more powerful people had learned to travel farther out on the ocean. They had traded with China, India, and even with South Africa, going to these lands by water in their sailing vessels. Their ships carried rich loads or cargoes of silks, spices, gold, ivory, wool, linens, and other things.

Spain and Portugal are two of these countries that

had built many large, strong sailing ships. Gunpowder had been invented. These ships carried guns to protect themselves from robber ships if they should meet them. Ships of these nations carried goods to all the lands that people knew about up to that time.



COLUMBUS'S CHIEF SHIP, THE *Santa Maria*

One day three ships sailed away from Spain. Christopher Columbus was on his way to try to find for his country a better way to go to India than the one they were then following. The pictures of his ships give

us a very good idea of how the best boats of that time were built. Study as many of these pictures as you can find.

After America was discovered and people from across the ocean came here to live, they needed goods of all kinds. These were sent to them in sailing ships. Our own country began to build sailing vessels. They learned to build boats that were strong and swift and that had a large space for the cargo. They found how to put the sails on their ships so that they could make every little breeze help them along.

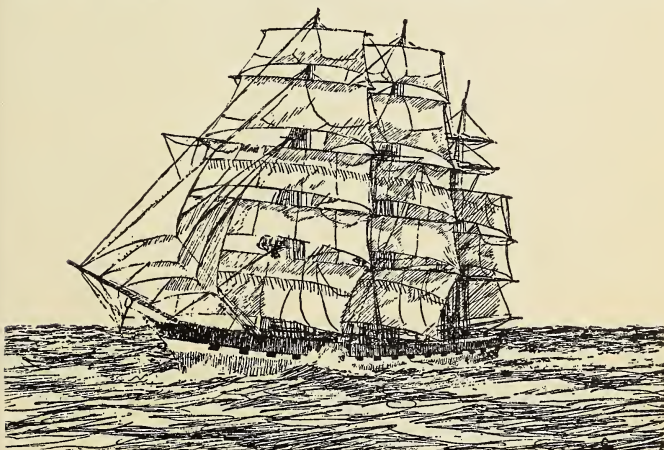
SCHOONERS, CLIPPERS, AND OTHER SHIPS

Some of the early two-masted ships built in our country were named *schooners*. This is supposed to be because some one who saw the first one sail through the water said, "Oh, how she scoons." The builder then said, "A schooner let her be." Men still build schooners today. These boats are used for carrying fish and other heavy goods on large lakes and upon the ocean.

Several other kinds of ships were built to carry on trade along the coasts of our country and between our country and lands across the oceans. Some of these were called *cutters*, others *brigs*, and still others *barks*. Can you find out some of the differences between these ships?

It was not long before regular trips were made across the ocean by ships known as *packets*. These boats carried goods, mail, and people just as stagecoaches did on land.

People had learned to use and to like many things that they had not known about in earlier times. Some



ONE OF AMERICA'S FAMOUS CLIPPER SHIPS

of these things would spoil on long trips in damp ships. Traders needed to get goods quickly from place to place. Also more people wished to travel to other countries. They did not like the long slow ocean voyage. The next ships to be built were called *clip-pers*. What does this name tell you about these boats?

Clippers were really very swift schooners. These ships were the largest that had been built up to this time. They carried heavy cargoes and passengers. Sometimes these great sailing vessels belonging to different countries raced to see which country had the fastest ship. These ships had such names as *Challenge*, *Flying Cloud*, *Lightning*, and *North Wind*. The fastest of the clippers could go from New York to Liverpool in about two weeks if the winds were favorable.

These fast ships were sailing across the ocean at about the same time that covered wagons, or *prairie schooners* were carrying whole families from the East toward the West in our own country.

MORE TO THINK ABOUT AND DO

1. Are you making a set of pictures and writing what the pictures do not tell about the story of transportation? What pictures will you need for Unit Four?

2. Try making a small sailboat. Blow against the sail as your boat floats on a pan of water. Can you turn the sail so that the boat will go in different directions?

3. Write at least ten sentences that tell the most important parts of this story.

4. Rewrite the sentences, leaving a blank where the most needed word belongs. Give this test to one of your classmates.

5. Play that you saw the clipper ship called *Challenge* coming into New York. Tell all you can about it.

6. Make a list of some of the things that boys and girls who traveled in clipper ships had that boys and girls of the earliest days who lived in caves did not have.

7. Smaller sailboats are used a great deal for fishing and pleasure. What do you know about *catboats*, *yachts*, *sloops*, *yawls*, and *ketches*?

UNIT FIVE. STEAM MULTIPLIES TRANSPORTATION

I. IRON HORSES DRAW LOADS ON LAND

For years many men were building larger and swifter sailing ships to carry goods and people across the lakes, seas, and oceans. During this time other people had made some important discoveries and had invented several very useful things. These discoveries and inventions were to make great changes in the work that people did and in the comforts that they had in their homes.

Some one had learned how to make the wind pump water. How do you think they did this? Another person had invented a water wheel which turned stones to grind grain. These machines used the power of moving air or of falling water to do the work that man had done by hand. They are called *power machines*.

HOW THE STEAM ENGINE CAME TO BE

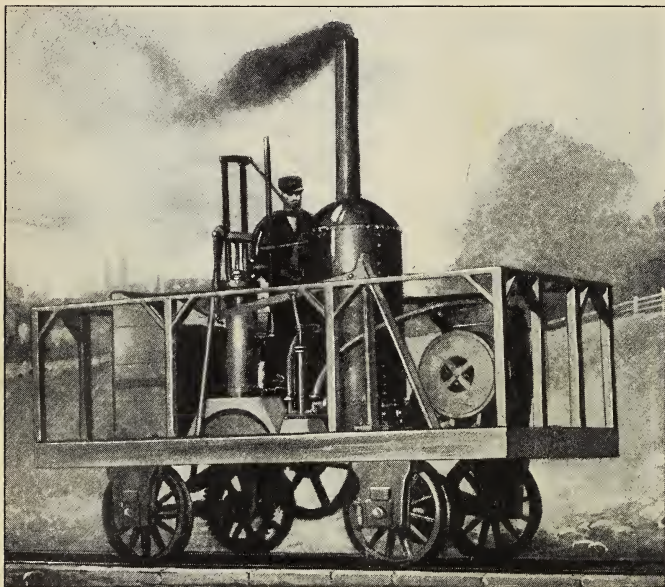
For some time men had known about and had used iron and coal. Another great power was waiting for some one to find it. It was *steam*. Steam engines were finally invented in Europe about two hundred years



Photo from Ewing Galloway

AN ARTIST'S IDEA OF HOW JAMES WATT CAME TO SEE THE POSSIBILITY OF BUILDING
A STEAM ENGINE

ago. These first engines looked queer to the people of that time. There was a fire in a stovelike box under a boiler. Water in the boiler was heated until it be-



Courtesy Baltimore & Ohio Railroad

PETER COOPER'S "TOM THUMB" — THE FIRST LOCOMOTIVE BUILT
IN AMERICA

came steam. As the steam was let out of the boiler a little at a time, it pushed so hard that it was strong enough to make a machine do its work. The smokestack of the steam engine was at the back of the fire

box. How the sparks and smoke did fly out of those early steam engines! Try to get some one to tell you more about how the steam engine makes power.

Iron ore and coal are so heavy that it was hard indeed for horses to draw the loaded carts from the mines to the ships. Some one tried a smooth track on which the carts could be drawn. Then fewer horses could draw larger loads. These wooden tracks gave men the idea of the iron track, called a *railway*. Yet they were not satisfied. They wished to carry heavier loads and more of them. Then it was that the "Puffing Billy" was invented. This was a steam engine on wheels that could pull several coal carts at once.

BETTER STEAM ENGINES PULL CARS

Another inventor named George Stephenson studied engines, railways, and wagons. He built a better engine for pulling carts loaded with coal and iron on rails. After a while he was given a chance to prove that an engine was better than horses for pulling railway cars carrying people from place to place. Stephenson's engine pulled the first steam-drawn railroad train that carried people and goods. He then built a better engine called the "Rocket." The locomotive took a prize in 1829. It drew loaded cars and ran almost thirty miles an hour. That is as fast as some trains go today.

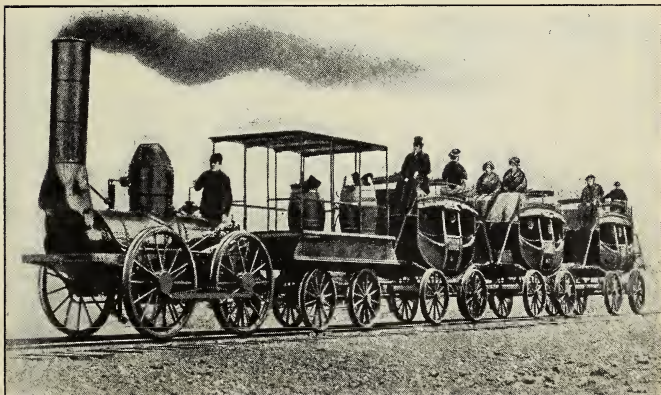
After man had found a way to make a machine draw loads for him, it became necessary for him to find a way to stop the machine or slow it down when he wished to do so. Can you think how he might do this? We believe that he remembered how he stopped a rolling log by putting his hands on the log and pressing against it.

This gave man the idea for the *brake*, or the friction brake, as it is called. Stephenson had a brake on the engine that drew his first train. Later on, brakes were also put on the cars in a train. Can you see why this would need to be done? These brakes were worked by hand. A man turned a wheel which tightened or loosened the brake.

In our country as well as in Europe men had been using horses to pull passenger wagons on tracks. About one hundred years ago the first steam locomotive built in the United States drew a train of cars on the Baltimore and Ohio Railroad. It was called the "Peter Cooper" after the man who built it. Peter Cooper also built the "Tom Thumb" for the same railroad.

The "De Witt Clinton" was another early locomotive. It was named after the man who was governor of New York State at about that time. This locomotive with its three cars is still kept by the New York Central Railroad. It is in the Grand Central Station

in New York City. You can see it there when you visit New York. These early cars were without springs. They had no glass in the windows. They

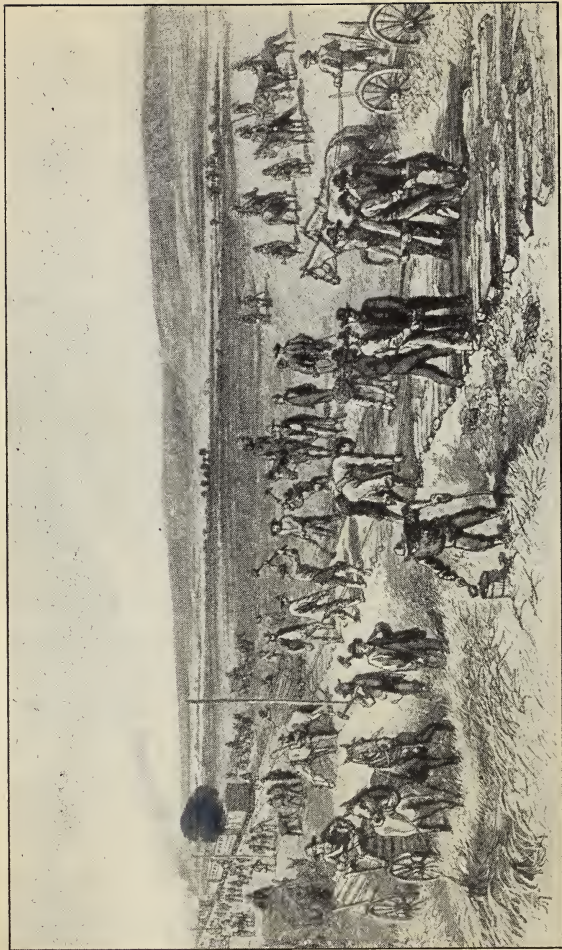


Courtesy New York Central Railroad

THE "DE WITT CLINTON" — A FAMOUS EARLY LOCOMOTIVE

looked like a row of stagecoaches. How would you like to ride in one of them on a cold day?

Our country is very large. There were hardly any good roads anywhere. The only way there was to get goods out of the middle of the country to the cities on the seacoast was by wagons. The roads over the hills and mountains were poorly made. Travel was very slow. For years long trains of covered wagons hauled valuable goods over these roads. Many of them traveled over the *National Pike*. This was the best



Courtesy of Union Pacific Railroad

BUILDING THE UNION PACIFIC RAILROAD IN NEBRASKA

road between the East and the West. There was a great need for railroads to carry on transportation from the inland places to the seaports where ships could take the goods across the oceans.

THE BUILDING OF EARLY RAILROADS

The building of railroads went on more and more. Engines became bigger, stronger, and cheaper to run. Passenger cars soon were made with glass windows. Stoves and lamps were added. Why do you think we still call passenger cars *coaches*?



Courtesy Pennsylvania Railroad

A MODERN STEEL HORSE

(Reproduction of the "Spirit of America" by Grif Teller)

As engines became more powerful, they became heavier. The roadbeds on which the *ties* and *rails* were laid were made wider and stronger. They had to be made safe for use both in summer and in winter. Why?

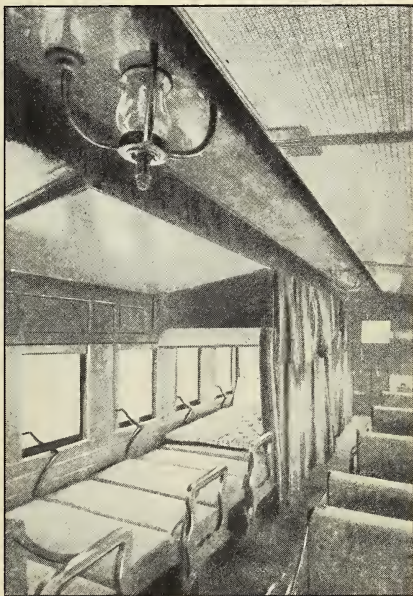
If railroads were to reach from one side of our country to the other, it was necessary for them to cross marshes, rivers, and deep valleys. This called for the best work of bridge builders. These great bridges had to be so well built that winter snows and summer rains could not harm them. Railroad bridges are carefully watched to see that they are always in order. A broken bridge may cost the loss of many lives.

There are high mountains in our country—some of them in the East, more and higher ones in the West. An engine can pull only a small load up steep hills. Sometimes two engines are used to pull and another one to push heavy trains up the mountains. A better way is to build the railroad around the sides of the mountain. Then the road is not so steep. Railroads often wind round and round so that they may cross high places without climbing too steeply.

In other places men have dug long tunnels through mountains. The trains run right into the mountain, it seems, and come out the other side. How do tunnels help transportation?

GEORGE PULLMAN AND THE SLEEPING CAR

The first railroads were only a few miles long. As they reached farther and farther, it took more than a day to make a trip. Then some one thought about helping busy people by making a sleeping car out of a daytime coach. Then people slept as they traveled at night. They had their days for other things. In 1859 George Pullman built his first sleeping car with more comfortable bunks or berths in it. Dining cars were added to trains so that people could also eat as they traveled. Now trains have bedrooms and cars like living rooms, and even bathrooms and barber shops!



Courtesy Pullman Company

AN EARLY TYPE OF PULLMAN SLEEPING
CAR

BETTER BRAKES MAKE TRAVEL SAFER

As locomotives were made better in other ways and drew trains faster, there was need for stronger brakes.

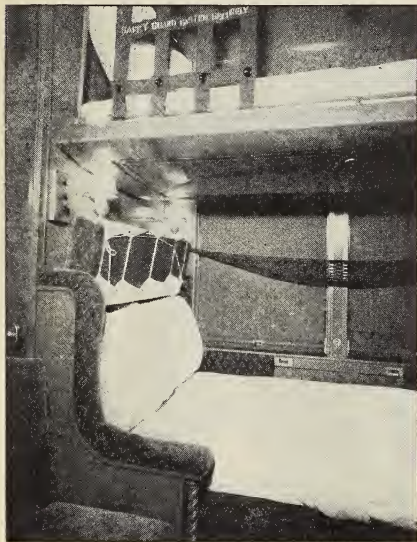


Photo from R. I. Nesmith and Associates

A SECTION OF A PULLMAN SLEEPING CAR

Brakes that would work without taking so much of man's time would also be still better.

It was George Westinghouse who invented the *air brake*. He asked the head of the New York Central Railroad System to give his air brake a trial. Cornelius Vanderbilt laughed at him.

Near Pittsburgh in 1868 another railroad owner had the air brakes built into a train. The brakes worked better than anyone believed they could. Now a whole train can be slowed down gently by a turn of the engineer's hand. If it must be done, a train can be stopped

before it has gone its own length. The next time you are on a train try to find out more about the air brake.

DIFFERENT CARS FOR DIFFERENT KINDS OF TRANSPORTATION

Freight cars have changed just as much as have passenger cars. Now there are different kinds of cars for the many kinds of goods to be transported. Cattle cars, tank cars, box cars, platform cars, and refrigerator cars are only a few of the kinds used today. Can you name some of the goods that you know are transported in these cars?

With better freight cars there have come improved ways of getting goods ready to be transported. People who send goods away see to it that things are clean and fresh when they start out. In our country goods must be packed in the way the government has ruled so that those who buy them will find them fit for use. What are some of the ways of packing goods that you know about?

TRANSPORTATION ROUTES HELP MAKE LARGE CITIES

When the great railroads were first being built, they were planned to go from inland cities to seaports. After a time other railroads were built between the inland cities. As these cities grew larger, railroads

were needed to carry goods between them and other still smaller towns and villages.

Now we find that nearly every city or village in our country is either on or near a railroad. Large cities



Photo from Ewing Galloway

A SO-CALLED "LOUNGE" CAR WHERE THE AIR IS KEPT WARM IN
WINTER AND COOL IN SUMMER

have so many railroads running into them that they are called *railroad centers*. In these great railroad centers goods are changed from one railroad to an-

other until the goods finally reach the city or little village to which they were sent. Perhaps they may cross an ocean before they get to the end of their journey. Can you tell how this might be?

When you see a beautiful passenger train moving swiftly along or a long freight train of perhaps fifty cars, you can now understand how much steam has helped man to move his goods across the land. Think how different is the journey made today by a California or Florida orange going to New York from what it would have been if the orange had traveled on a covered wagon or had gone all of the way by boat.

Railroads much like those in the United States are found in many other countries, especially in Europe. There are also lands in which the boys and girls have never seen a train of cars. Perhaps you know already where some of those children live. Can you tell where they live?

MORE TO THINK ABOUT AND DO

1. If you can get *The World We Live in and How It Came to Be* by Gertrude Hartman — The Macmillan Company, look at the pictures in Chapter XV, "Putting Sunshine to Work," and in Chapter XVII, "The Iron Horse." Perhaps your teacher will read these chapters to you. You will need to ask many questions about some parts of the story.

2. *Clear Track Ahead* by Henry Lent — The Macmillan Company, is a book you will wish to have for

your library. It tells much that you will like to know, especially if you are a boy.

3. Ask some one to read to you some of the Suggested Library Readings for Unit Five, Part I.

4. There are a good many new words in this story. Will you make a list of these? Perhaps you can use them in sentences so that you will remember them when you wish to use them.

5. Would you like to get as large a collection of "folders," or time-tables, from as many different railroads as you can for your school? What are some of the things you could do with these folders?

6. Could you and your classmates make up a little play in which the engines are made to talk like people and tell what they do to help transportation?

7. Remember you are gathering pictures of transportation. Perhaps you are also drawing large pictures to tell the story of transportation from long ago to now.

8. Tell about the most interesting train trip you ever took.

9. Perhaps you have in your library *How the World Grows Smaller* by Beeby and Beeby — Charles E. Merrill and Company. If so, please read pages 120 to 154. This book will tell you more about railroads.

II. STEAMSHIPS CARRY GOODS ACROSS THE OCEAN

Even before the days of railroads, man had been trying to use a water wheel to drive a boat. Some-

times men turned the wheel. Sometimes a horse did it. People had also learned to use iron for many things that they had been making before from wood. They had put iron bands on their wooden ships to make them stronger.

For quite a while people did not think that steam engines could be used on boats. They thought that the iron engines with the wood or coal that they burned would be too heavy. They said also, "What shall we do if the engine breaks?"

THE FIRST STEAMBOATS

Over in Scotland, almost one hundred fifty years ago, a steam engine for the first time turned the paddle wheels of a little tugboat. It was this steam tugboat that gave Robert Fulton the idea for building his steamboat.

You have learned that rivers have been used from the earliest days for transporting goods. In our country the long rivers helped the people to travel far inland to build their homes. Because of the large rivers in the middle of the United States, the people soon began trading with each other. Rafts, dugouts, and sailboats carried lumber and furs and many other things from place to place. Would you have liked a trip on a flatboat down the Ohio to a river port on the Mississippi?

Not much power is needed to carry a boat downstream, but a great deal more is needed to drive a loaded boat up a river. Why is this? People wanted something better than sails to drive their river boats.

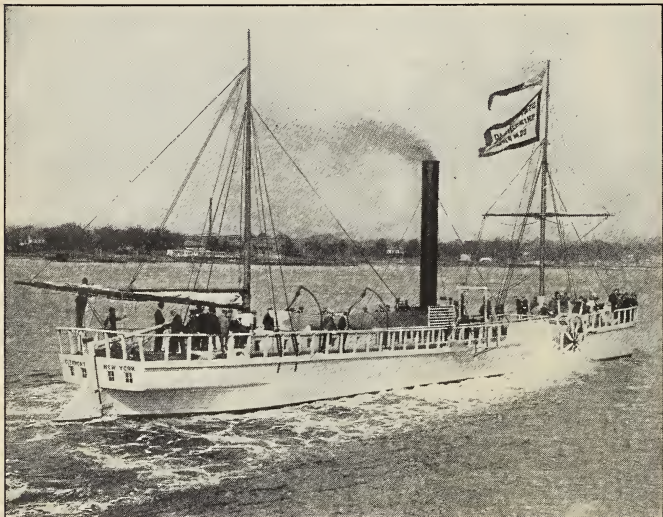


Photo from Brown Bros.

THE *Clermont* ON THE HUDSON RIVER

What happened when a sailboat tried to go upstream and the wind was blowing downstream?

Robert Fulton was sure that his steamboat could do what sailboats could not do. He worked hard on his new invention. People made fun of him, but he

kept on building his paddle-wheel boat. At last it was finished. The steam engine turned the paddle wheel on each side round and round in the water. They pushed the boat up the Hudson River. The *Clermont* had sails, but she did not need to use them. This first steamboat in our country afterward made regular trips from New York City to Albany carrying goods and passengers.

EARLY STEAMBOATS ON RIVERS, LAKES, AND OCEANS

Soon other steamboats were built for use upon rivers and lakes. These early steamboats also had sails. Long before railroads were built, goods and people were transported up and down the Mississippi and other rivers and upon the Great Lakes. Some of these boats had their paddle wheels at the back end of the boats. Why do you think they were built in this way?

A little over one hundred years ago the *Savannah* crossed the Atlantic Ocean to Liverpool. This ship was both a sailboat and a steamboat. She had paddle wheels that could be let down into the water to be used when there was no wind or when it blew the wrong way. She used her paddle wheels part of the way on the ocean. When the sailors on other ships first saw the *Savannah* without her sails and with smoke pouring out of her smokestack, what do you think they said?



From a painting by Stanley M. Arthurs

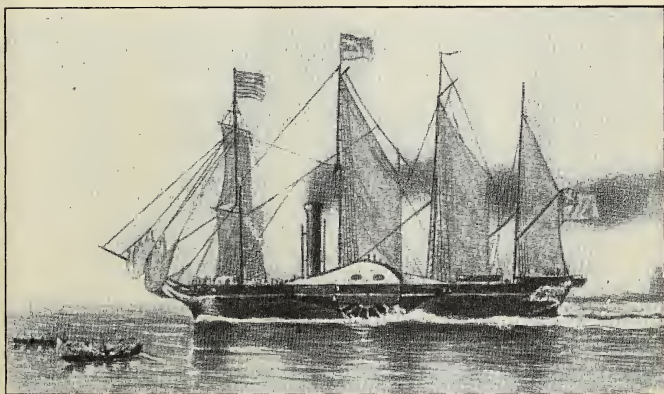
THE *Savannah* ARRIVES IN ENGLAND.

BETTER OCEAN TRAVEL AND TRANSPORTATION

What a great day it was in New York City when, in 1838, the *Sirius* came into port having made the whole trip from England under steam power! A few

hours later the *Great Western* came in sight. She, too, had come from England. So it was that steam power began to help man send his goods to far-away places.

More and more steamships crossed the oceans and made long trips along the coasts. Then people found



THE Great Western

out that they could tell just about when the ships would get to their ports. Why could they not tell this about sailing ships? Slowly the steamship was taking the place of sailing ships for many kinds of transportation. Can you tell why?

In 1840 Samuel Cunard, an Englishman, built four ships to make regular trips, each at a given time.

People could plan ahead to travel or to send goods on these ships. They went back and forth across the Atlantic Ocean, carrying passengers, mail, and freight. This was the beginning of the great steamship company today known as Cunard-White Star, Limited.

THE SCREW PROPELLER

Have you ever made a pinwheel out of paper? What happens when you run with it? If you have done this, you can easily understand what the next great improvement in steamships was. Men learned, by trying over and over, that there was something even better than paddle wheels for driving ocean ships. It is a propeller.

A propeller is shaped much like a pinwheel. It is made to spin in the water with the power from the engine. This drives the boat ahead much faster than paddle wheels can.

The *screw propeller*, as it is called, is built into the bottom of a ship near the back end. Some ships have two propellers. Then one is on each side of the bottom of the boat near the rudder. The *Great Britain* was the first ship to be built of iron. She was also the first to have a propeller instead of paddle wheels. Where do you think this ship was built?

No matter how good new things seem to be for a while, they do not satisfy all of the people for very

long. By the year 1900 ships were being built of steel instead of iron. Long before, steamships had ceased to carry sails. Can you tell why?

DIFFERENT KINDS OF SHIPS DO DIFFERENT KINDS OF WORK

Another new invention was built into these ships. It was an improved engine. This is called a *turbine*. This engine gives greater power, is smaller, and costs less to run than did the earlier engines. Perhaps some day you can see a turbine engine doing its work.

Just as there are different kinds of trains, so there are different kinds of ships. There are splendid fast ships built just to carry people, mail, and express. There are other ships built to carry freight down deep in the ship and passengers in the upper parts of the ship. Then there are ships built for carrying certain kinds of freight.

Some of the freight ships are named either from their shape or from the work they do. What can you find out about *tankers*, *whalebacks*, *refrigerator ships*, and *ore carriers*?

There are two kinds of ships that do not carry goods, but they do help transportation. *Ice breakers* are needed in all cold countries. Can you tell what they do? How do you think they are built? Tugs help all the big ships come into and go out of their ports. These

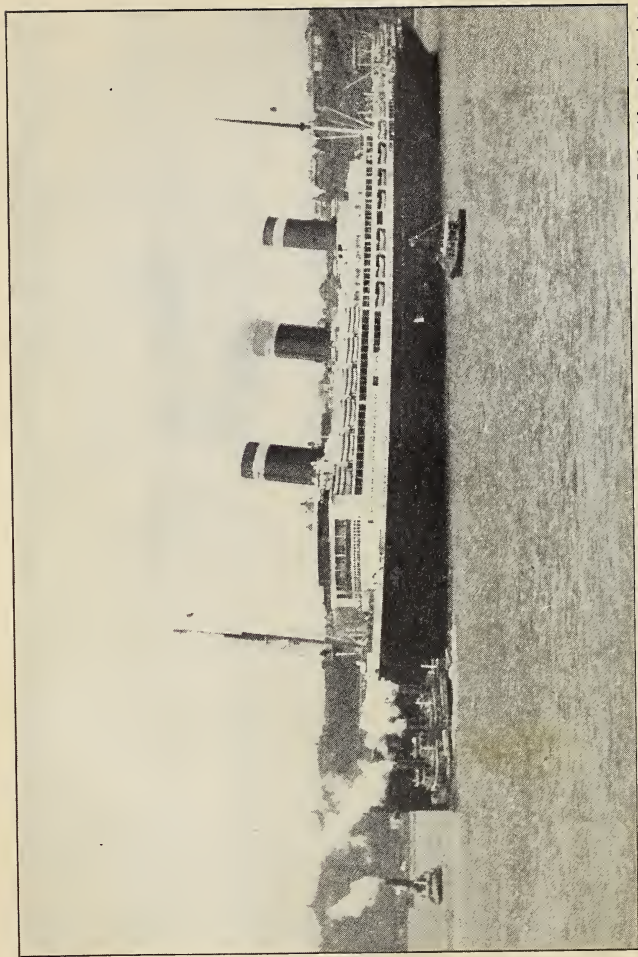


Photo from R. I. Nesmith and Associates

TUGBOATS PULLING A TRANS-ATLANTIC LINER

big ships cannot use their propellers where the water is not deep. The strong little tugs push and pull them about until the big ships are just where they wish to be. How do you think they can do this?



Photo from Ewing Galloway

A HUDSON RIVER FERRYBOAT ENTERING ITS SLIP

Tramp ships are really freight ships that do not make regular trips. They carry goods to any port for anyone who pays them to do it.

Ferryboats carry people, automobiles, or big trucks across water where there are no bridges. Some ferryboats are so small that only one automobile can be

carried at a time. Others are so large that an engine and several railroad cars can be carried at one time.

You will, I am sure, by this time wish to take an ocean voyage. Then you can learn for yourself more about the ships that carry so much of the world's goods and bring to us so many beautiful and useful things from far-away lands.

You will find your ship steam-heated, electric-lighted, and having hot and cold water just like a very fine large hotel. It will have great dining halls and playrooms. It will have no sails. What does this tell you about steam as a helper to man?

MORE TO THINK ABOUT AND DO

1. Beginning with "The First Boats" on page 17 make a list of all of the ways man has found to travel on the water up to the end of this story.

2. Can you think of more ways of traveling on water that you have learned about from reading in other books? Try to recall these and tell the class what you can about them.

3. Make a list of the words that name:

- (a) any parts of steamboats
- (b) places where boats were built and ports to which they came
- (c) men who helped transportation by steam power
- (d) steamships that we should remember
- (e) boats that do different kinds of work for man

4. Make believe you were sitting on the bank of the Hudson River and saw the *Clermont* on its first trip. Tell us what you saw, what people said, and what you did after the ship had passed.

5. *The Ship Book* by Peter Gimmage — The Macmillan Company, will tell you many interesting things about ships.

6. If you liked *Clear Track Ahead*, you will like *Full Steam Ahead* by Henry B. Lent — The Macmillan Company. It tells about a trip across the ocean on the steamship *Paris*.

7. What happened near Baltimore about the time the *Savannah* crossed the Atlantic Ocean?



Photo from R. I. Nesmith and Associates

THE *Bremen* ABOUT READY TO LEAVE ON ITS HOMEWARD TRIP

UNIT SIX. WAYS AND MEANS FOR SHIPS AND TRAINS

I. OCEAN PORTS AND OCEAN PATHS

Long ago when men used dugouts or rafts to carry their goods from place to place on water, they could easily pull their boats upon the shore almost anywhere to unload them. When ships were built larger and moved by themselves, landing places had to be built for them. Why was this?

HARBORS, PIERS, AND DOCKS

Along the coasts of any country there are some places where the deep water extends far into the land. In these places the water is smoother than it is out in the ocean. We call such places *harbors*. Here men have built *wharves* at which ships can load and unload.

To build a wharf out over deep water, long *piles* made of logs from tall trees are used. These are driven deep down through the water into the ground below. A great hammer called a *pile driver* is used to do this. Strong wooden planks are nailed to the tops of these piles. Sometimes, iron, steel and concrete are used in building wharves, or *piers*, as they

are also called. Have you ever walked on a pier? It seems much like walking on a big bridge.

In large cities where there are many boats coming into the harbors, the wharves are built, one after another, straight out from the land into the water. Boats are then landed along the sides of these wharves. We say that such a boat is in a *slip* or in a *dock*. What is a dock?

When a ship wishes to land, it is almost always pushed into a dock or up to the side of a long wharf by one or more tugs. Strong ropes tie the ship to the wharf. A little bridge is made by laying a *gang-plank* from the wharf to a floor, or *deck*, of the ship. If there are passengers on the ship, they go off first.

Then the freight is unloaded. Some of it is put into trucks. Some is put into smaller boats. Some is carried to great buildings near by called *warehouses*. On some wharves railroad tracks run to the water's edge. Then goods can be carried on to the freight cars right from the ship. What a busy place a pier or wharf is when ships have just landed or are getting ready to leave!

Sometimes a ship's journey is not ended when it docks at one large seaport. It may leave only part of its goods, or *cargo*, at one place. It may leave more goods at another port. Perhaps it may even go part way up a very large river to still another city before

it begins to take on goods for its trip back to the place where it started. Do ships carry the same kinds of goods both coming and going? Tankers go home empty. Why is this?

Men have known from earliest times that transportation by water is cheaper than transportation by



Courtesy James Sawders

LOADING COFFEE AT A COLOMBIAN PORT

land. Any kind of transportation, however, takes time, work, and some means for carrying goods. So, whether by land or water, the shorter the journey or route, the less it costs to send goods. Why do traders

think so much about this? You remember that Christopher Columbus was trying to find a shorter water route to India for his country when he discovered America.

HOW OCEAN ROUTES WERE SHORTENED

A way of making shorter ocean routes between the great trading countries was finally found. This was done by cutting big ditches in the narrowest strips of land that separated the great seas and oceans from each other.

Men dug these ditches deep enough and wide enough for the largest ocean boats to go through them. The sides of the ditches were carefully made so that they would not wash away. Then the water was let into the *canal*, as it was called.

HOW THE SUEZ CANAL HELPED TRANSPORTATION

The longest ship canal is the Suez Canal. It was opened in 1869. It made a short waterway from the Mediterranean Sea through the Red Sea to India and China. This was what Columbus had tried to do in 1492. Why was this plan better than the one Columbus tried?

The Suez Canal was dug by a French company. Now, the English Government and some French people own it together. Ships of all nations may go through

the canal by paying a certain amount of money called a *toll*. People on the ships also pay about two dollars each to go through. The Suez Canal is one hun-

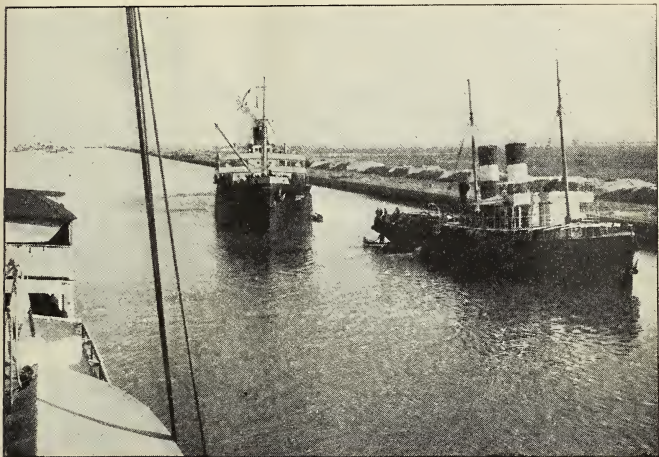


Photo by Burton Holmes from Ewing Galloway

SHIPS PASSING THROUGH THE SUEZ CANAL

dred miles long. It is lighted along the whole way. It takes about eighteen hours for a ship to go through the Suez Canal. Why does it take so long?

For years and years traders in our country wished to send goods all the way by water from New York to San Francisco. Why did they not do this if they wanted to do so? At last, man has found a way. It is the Panama Canal.

HOW THE PANAMA CANAL HELPED WORLD TRADE

This canal was begun by the same French company ten years after the Suez Canal was opened. The digging of this canal was much harder than the French thought it would be. Finally they gave it up even though they had done a large amount of work on it.

Then the United States bought the right to the land for the canal and paid for the work that the French company had done. Our country will always remember Colonel Gorgas and Colonel Goethals who planned and directed the great work of building the Panama Canal. All nations use the canal. They pay toll as they do at the Suez Canal.

The Panama Canal is a *lock canal*. The land where it is built is much higher in the middle part than it is near the oceans. You see then that the canal must have steps up and then steps down so that boats can go through the high parts of this waterway. In the *locks*, as these steps are called, the water is held by great, high water-tight gates.

When a ship is going into the Panama Canal from either end, it must go from lower to higher waters. It is pulled into a lock by a locomotive on the side of the canal. The gates are shut behind it. The lock then becomes a big water tank with just enough water in it to keep the ship afloat.

More water is then poured into this lock. The ship

risers higher and higher in the lock. This is because it stays on top of the water. The gates into the next lock, which is just like the first one, now open. The ship is pulled into this next lock which again has only enough water in it to keep the ship from scraping on the concrete bottom of the lock. Can you tell now how the ship can be raised to another lock? Can you tell how the ships come down steps in a lock canal?

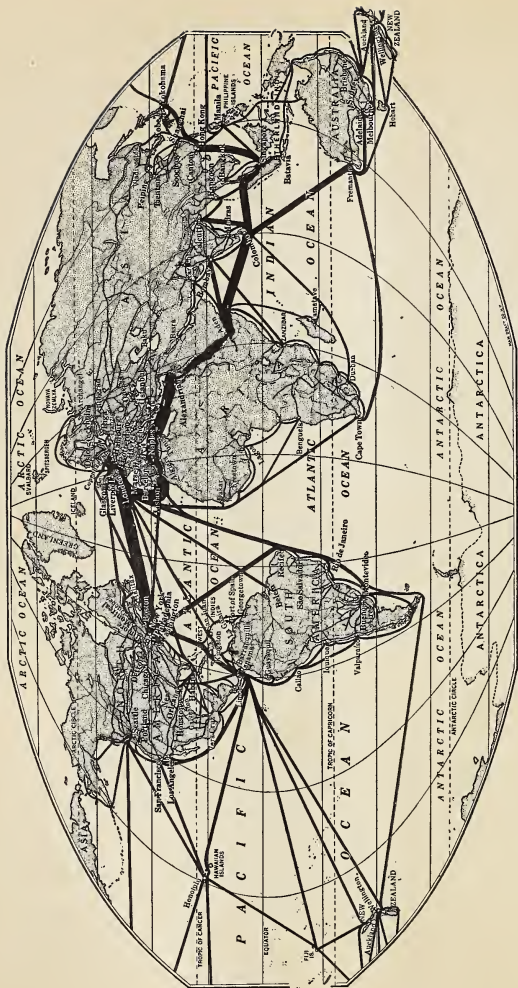
The Panama Canal is about fifty miles long. It is wide enough so that ships can be going through both ways at the same time. The locks near each end of the canal lift great ocean ships up eighty-five feet and let them down again to go on their way. The first ships went through the canal in 1913.

Trade in our country is greatly helped by the Panama Canal. It also helps other countries to carry on their trade by shorter routes. Look at a globe and find why this is true.

THE GREAT OCEAN ROUTES

You will see from the map on page 96 that men from many lands have tried to find and to use the shortest routes of trade between large cities that also have good harbors. Some of the world's greatest seaports are New York City, Liverpool, Hamburg, Alexandria, Singapore, Buenos Aires, and Sydney.

From the map find what routes the greatest number



TRAVEL LANES OF THE WORLD'S STEAMSHIPS

The width of the black lines shows the amount of trade along any route.

of ships follow. These are the routes of the boats that go back and forth between the same ports carrying goods and people. Such ships are called *liners*. Can you tell why?

You will see that one of the routes used the most goes through the Mediterranean Sea. Can you tell why so many steamship lines follow this route?

MORE TO THINK ABOUT AND DO

1. Try thinking "yes" or "no" after each of these questions.

- (a) Can man transport goods more cheaply by land than by water?
- (b) Can he travel more quickly by water than he can by land?
- (c) Was the *Clermont* an ocean boat?
- (d) Did the first sailboats use any other power than wind to drive them?
- (e) Did the first steamboats use any other power than steam to drive them?
- (f) Did animals ever help in water travel?
- (g) Does canal mean river?
- (h) Is a modern steamer like a hotel in many ways?
- (i) Is the United States the only country that uses the Panama Canal?
- (j) Is the Suez Canal near Egypt?
- (k) Is a harbor a place where ships can land safely?
- (l) Is a big city always a seaport?

- (m) Do all wharves have railroad tracks running out on them?
- (n) Do freight boats always carry goods both going and coming on their trips?
- (o) Do all steamships go through either the Panama or the Suez canals?

2. Write the sentences that answer these questions.

3. Make five other questions about harbors and five questions about canals to ask your classmates.

4. Study a map of ocean trade routes. Write the names of five great seaports besides those given in this story.

5. If you like to look at maps, plan some trips you would like to take.

II. INLAND ROUTES BY WATER AND BY RAIL

From the earliest days people in all lands have tried to use their rivers and lakes for transporting goods. Long before there were ships on the ocean, man had learned that ditches filled with water were as good as most rivers for transportation by boat.

Soon men saw that they could dig deep ditches between two rivers or from a river to a sea and really make a waterway through the land where they most needed it.

Some of the earliest canals that we know about were built in Egypt and in China. From the first, most canals have had a pathway along one side. This is called a

towpath. A strong rope is used to pull the boats along in the canal. This is a *towrope*. In early days men pulled the boats. Later mules were used to do this work.

Now on many canals a small tug pulls several loaded boats at one time. Some canals are so well built that



From an old print

A CANAL BOAT SHOWING THE TOWPATH AND THE TOWROPE

steamboats can go through them using their own engines. Why can they not do this on all canals?

Many inland canals have locks in them. These

locks work just like those in the Panama Canal. Of course locks in inland canals are much narrower than those in the Panama Canal, but a few of them lift boats about as high. Why do they need to do this?

HOW CANALS HELPED THE WEST

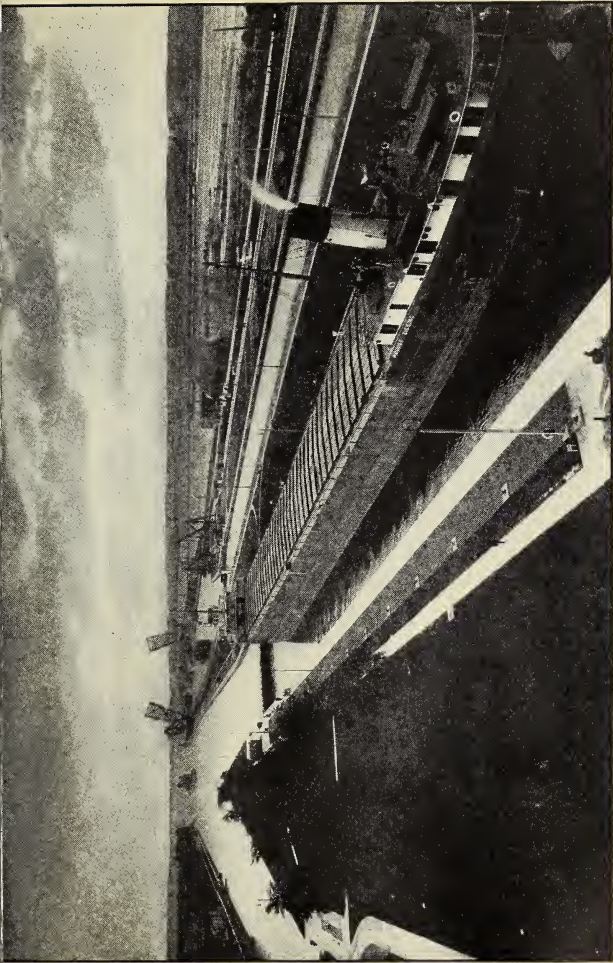
The best known canal in our country is the New York State Barge Canal, once called the Erie Canal. It



Photo from Ewing Galloway

LOCKS ON THE NEW YORK STATE BARGE CANAL AT LOCKPORT

was built from Buffalo to Albany in New York while De Witt Clinton was governor of the state. People



LAKE BOAT PASSING THROUGH THE SOO CANAL

Photo from Ewing Galloway

did not believe that anyone could dig a ditch that would hold water and carry boats for a distance of over three hundred miles across land that was hilly in many places.

In eight years the Erie Canal was finished and in 1825 the first boats were towed through it. Soon after this so many owners of boats wished to use the canal that it had to be made larger. This opened a waterway from the seacoast to the good farming land around the Great Lakes. How do you think this helped people to find new homes in the West?

A few years ago the canal was made wider and deeper. The locks were improved. The canal can now carry larger boats called *barges*. This has now given our country a great inland waterway for freight barges that reaches over one thousand miles into the country from New York City.

Three canals close together that have also done much to make transportation cheaper for the people living in the northern part of our country are the "Soo" Canals. They are between Lake Superior and Lake Huron. The Soo Canals have locks that lift or lower boats twenty feet. These canals with the Welland Canal, between Lake Erie and Lake Ontario, open a waterway for freight boats up the St. Lawrence River. This waterway reaches from Duluth, Chicago, Milwaukee, and other Great Lakes ports to the Atlantic Ocean.

THE FUTURE OF OUR WATERWAYS

Another inland waterway in the United States, partly man-made, reaches from Chicago to New Orleans. This route makes use of a canal and a smaller river to reach the Mississippi. What do you think barges on this waterway will carry going south? What will they bring back to the north?

Our people are now talking about making a waterway from the Atlantic Ocean to the Great Lakes that will be wide enough and deep enough for the great ocean liners to pass through. Which of the routes we now have do you think it would be best to make over for use by ocean steamships? Would you like to take a trip on this when it is finished?

Other countries of the world have built many more canals than our country has. The great countries of Europe use canals for a large part of their transportation. In Europe canals sometimes lead from one country into another. What country in Europe do you think has the most canals in comparison with its size? What are the reasons for this?

GREAT RAILROAD SYSTEMS HELP TRANSPORTATION

We have already read something about the building of railroads in the different countries. These railroads were being built at the very same time that canals and rivers were used so much for transportation of goods.

Even though they had waterways, men saw that both railways and waterways were needed to carry on trade. Can you think of reasons why this is true?

In our country each of the early railroads was usually owned by a different person or company of men. Each

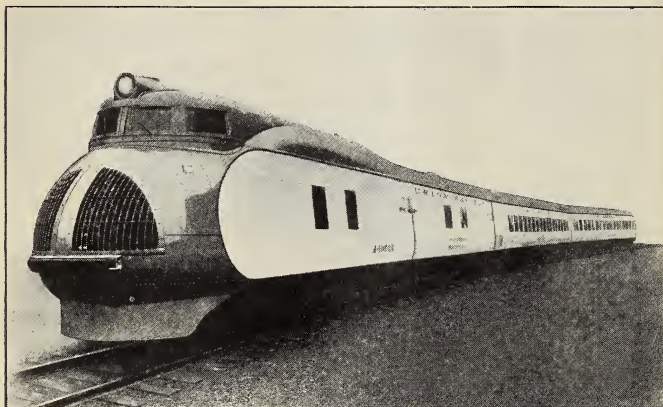


Photo from Ewing Galloway

A STREAMLINED TRAIN

company's trains might be quite different. Some of the railroad tracks were wider than others.

When these early passenger trains came to the ends of their lines, all the people would get out of the cars. They would go to the places where the next railroads began, buy other tickets, and get on other trains. Before the year 1870 there were eleven such changes between New York City and Buffalo.

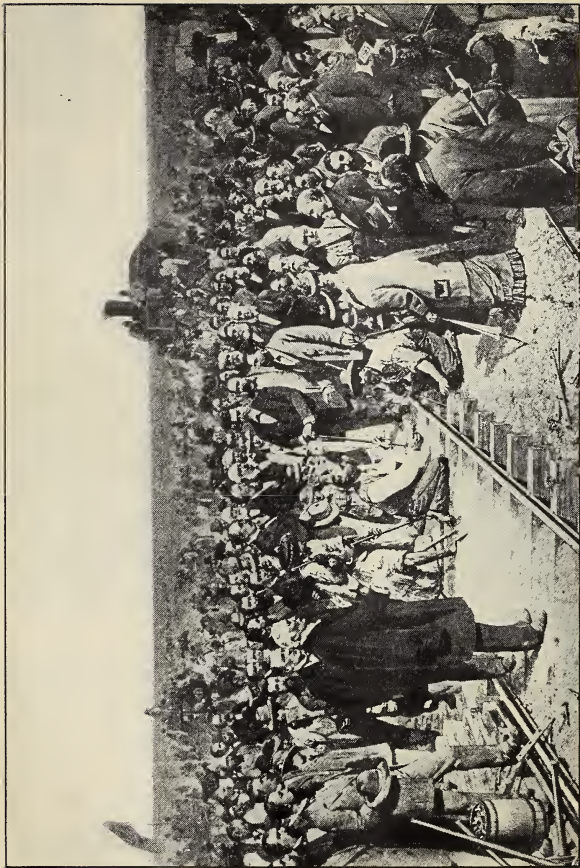
When freight was sent on these trains, it had to be unloaded and loaded again every time it reached the end of a railroad line. What often happens to goods that are moved about in this way? What about the cost of transportation by rail at this time?

Soon railroad owners found a way to make railroad travel and transportation better. Eleven railroads in New York State joined together and became the New York Central Railroad System. What were some of the changes these roads would need to make in width of track and in other ways?

Many other small railroads began to work together. These also became railroad systems. This made transportation much better. Goods could be carefully packed into a car. They could often stay in that same car until they reached a small town to which they might be sent. This would be true even if the car went through several railroad centers. Can you tell how this could be done?

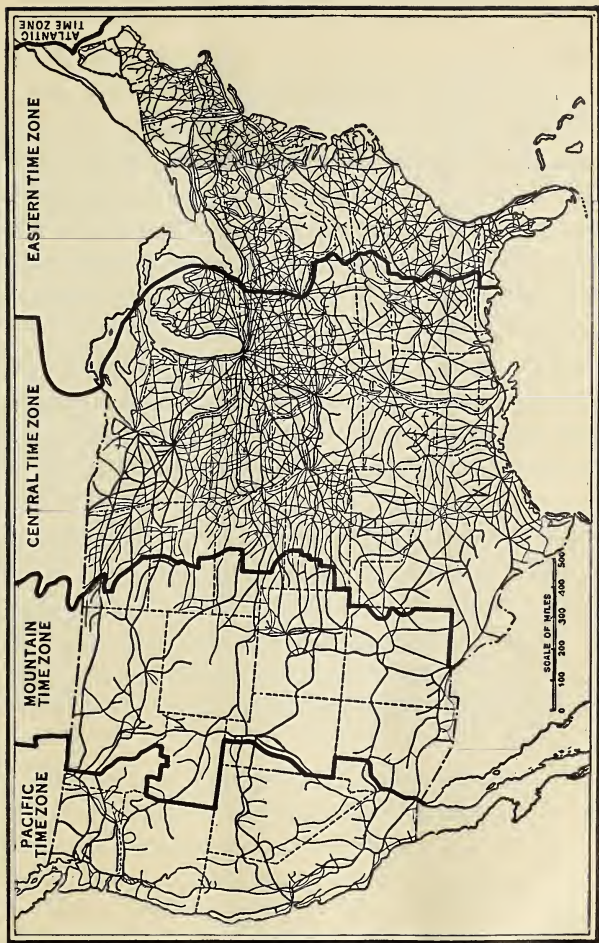
There were no large rivers beyond the Mississippi that helped people to go to the Far West. The people who went west in the early days traveled in long trains of covered wagons. In this way they could help each other.

Men who thought a great deal about what the United States needed then and would need later on said that, if our country was to have enough long rail-



Courtesy Southern Pacific Co.

"DRIVING THE LAST SPIKE," A PAINTING BY THOMAS HILL TO REPRESENT THE JOINING OF THE RAILS OF THE CENTRAL PACIFIC R.R. AND THE UNION PACIFIC R.R. AT PROMONTORY, UTAH



THE SPIDER'S WEB OF RAILROADS OF OUR COUNTRY

roads going from coast to coast, the government must give some help in building them. Why was this?

These companies asked the government to give them strips of land on which to build their railroads. With this help some of the long western railroad lines were built by single companies. The Union Pacific Railroad was finished in 1869. Other early railroad systems leading west were the Southern Pacific, the Northern Pacific, and the Great Northern.

Today, in our country, the great railroad systems have cars and tracks so nearly alike that people go from one great railroad system to another without even knowing it. Freight cars are switched to the tracks of another company and go on their way.

Besides this there are six railway systems that are so large that their tracks reach all the way from the Middle West to the Pacific Coast. At all times several railroad systems carry on trade in the same part of the country. In some cities they use the same depots, or stations. Then these are called *union depots* or *union stations*.

Many of the other great nations of the world have also built up large railroad systems. In these countries, as in our own, goods can go by railroad routes from place to place without being unloaded. Europe has more railroads than any other part of the world except the United States. Can you find out why this is so?

MORE TO THINK ABOUT AND DO

1. *The Train Book* by William Clayton Pryor — Harcourt, Brace and Company, is a book you will enjoy. The pictures will tell you a great deal. Some one will help you read the story.

2. Can you make a canal either in the sand table or in the yard? Could you build a lock in your canal?

3. Are you remembering to find pictures of all kinds of transportation? Do you need another envelope in which to keep them?

4. Are you making your picture-story of the things that made the greatest differences in transportation?

5. Before the Erie Canal was built, the Ohio River was one of the leading waterways from the East to the West. Why was this so?

6. Can you find out whether most of the transportation of goods in our country today is by rail or by boat?

7. Find as many stories as you can that tell about sending goods.

8. Name goods that go by water.

9. Name goods that are sent by rail.

10. Make a list of the words in this story that you think you will need to use to help you tell it to some one else.

11. If you can look at *The Picture Book of Rivers* by Allan McNab — The Macmillan Company, you will enjoy it very much.

12. On which would you rather have traveled in the early days: a canal boat, a river steamer, or a lake steamer?

UNIT SEVEN. MAN LEARNS TO USE MORE OF NATURE'S GIFTS

I. ELECTRICITY DRIVES STREET CARS AND TRAINS

We know that very early man had to learn little by little how to make all of the things that he and his family used. We have seen that he kept on trying different ways until he had better food, more comfortable clothing, and a more pleasant home in which to live. Later, he found that he could get wind and water, as well as fire, to work for him.

We have read about the great changes that the uses of steam made in man's ways of traveling and of sending goods over long routes. Helpful as steam locomotives and steamships are, however, they cannot be used in many places where a great deal of transportation is carried on. Even today horses draw wagons that do much of this work. Where are some of these places?

EARLY TRANSPORTATION IN CITIES

For years and years there was no other way of carrying people on the streets of cities except by using horses. Some people rode on horseback. Others went in carriages. Those who had no way of riding walked.

As cities grew larger, people began to live farther and farther from the offices, stores, and factories. They needed to go to and from their work as quickly as they could. Why? Many people could not afford to keep a



Photo from Brown Bros.

A HORSE CAR OF THE NINETEENTH CENTURY

horse. Horses needed care, and it took time to harness or saddle them. Besides they must be fed and watered during the day while their owners were at work.

Some one saw the need for better ways of transporting people. Iron tracks were laid in the streets of large cities. Street cars drawn by horses made regular trips over routes leading from the business parts of cities out

to the places where people had built their homes. How do you think men came to think of this plan?

One of the earliest of these street car lines began carrying people in New York City in 1832. What else

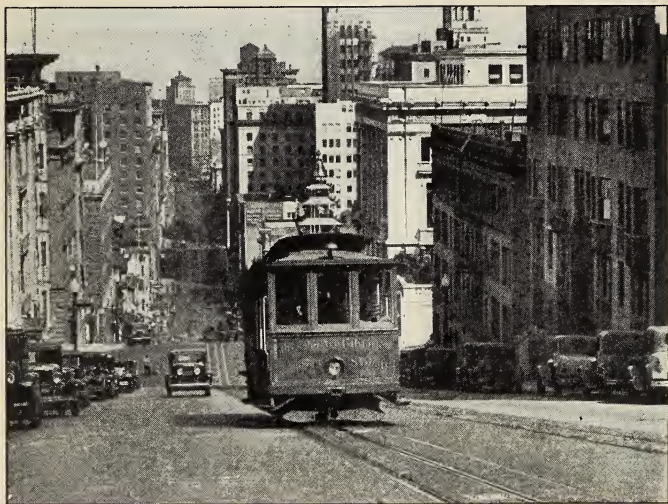


Photo by De Cou from Ewing Galloway

A CABLE CAR CLIMBING A STEEP STREET IN SAN FRANCISCO

happened in our country at about that time? People were very happy for a little while when these better ways of travel were built. What should we think today about riding in a horse car?

Horse cars, however, pleased the people they carried for only a short time. The cars did not go fast enough.

Then cable cars were invented. These cars were run by a steam engine at one end of the line. This engine pulled a strong rope, or *cable*, through an underground pipe laid between the tracks. There was a small space left open in the top of the pipe. This was called a *slot*. A long hooklike arm on the car reached down and caught hold of the moving rope. This pulled the car along with the cable. When a stop was to be made, the arm could let go of the cable until it was time to start again. Cable cars much like these are used today for going up and down the sides of steep mountains. Perhaps you can ride in one some day.

Cable cars were faster than horse cars. What were some other things about them that were better? Cable cars had not been used long in our country when the people heard about what was happening over in London. There Michael Faraday, who worked in a book bindery, was studying about the new discovery known as *electricity*. Finally he gave up his trade and worked all the time with other men who were trying to find out more about electricity and what they could do with it.

FARADAY AND HIS DYNAMO

One day, after working seven years, Faraday found a way to start an *electric current*. In 1832 he built a little machine to do this. This was the first *dynamo*.

“Dynamo” is from a Greek word that means power. Then other men took up Faraday’s idea. They knew that electric currents would travel on wires. They also knew that both steam and water power would run machines.

Here seemed to be a way to use coal wherever it was to make steam to run a new kind of machine. This machine would make power that would go on wires to any place where it was needed. In what places would they use water power to do this work?

EDISON AND THE ELECTRIC STREET CAR

Thomas Edison was one of those who improved the dynamo. It was he also who found a way to make an electric engine, or *motor*, that would work well in street cars. Such an engine would be run by an electric current made by a dynamo with water or steam power.

By 1910 electric street cars were being used in many cities. These cars are driven by electric current often made by a dynamo several miles away. The *power wires*, or *overhead trolley wires*, are in the streets above the tops of the cars. On each car is a long arm called a *trolley pole* which reaches this wire. On the end of the pole is a little wheel which presses on these wires as it rolls along on them. This is the *trolley wheel*. The electric current goes down the trolley pole to the motor and turns the wheels of the car.

After a while cities found that the overhead trolleys were in the way of other things and they were glad when some one invented another way of carrying electric

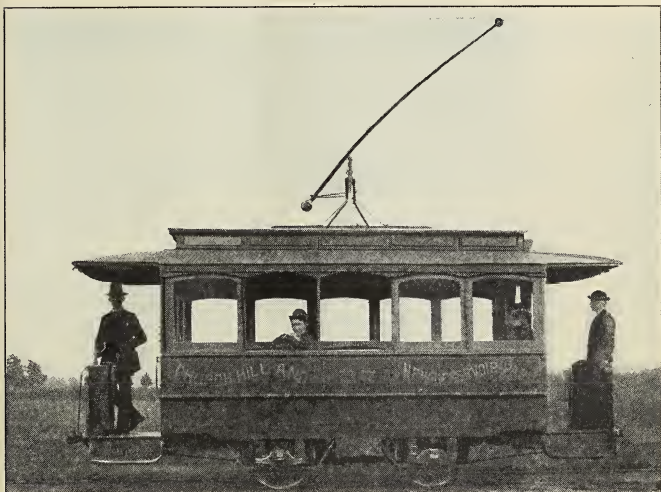


Photo from H. P. Cook

THE FIRST TROLLEY CAR IN RICHMOND, VIRGINIA

power. This is by having the *power rail* in the ground between the tracks. Then an arm on the bottom part of the car reaches down through a slot to the power rail. Do you see how this idea came from the cable car? After a while some cities grew very large. On some of the streets there would be, at times, great crowds of people. The street cars could move only

very slowly. Some new plan was needed to give better transportation for the busy people who were hurrying to and from work.

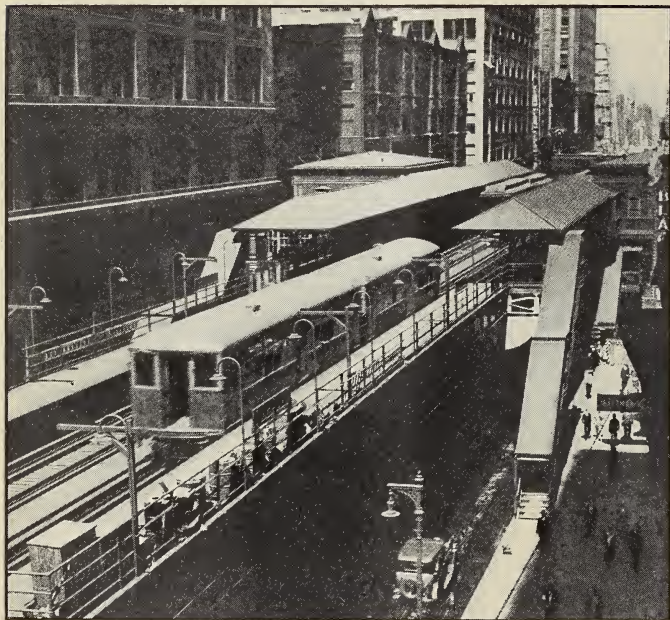


Photo from Ewing Galloway

THE ELEVATED IN DOWNTOWN CHICAGO

THE ELEVATED TRAIN AND THE SUBWAY

The *elevated train* was invented. This is a train of cars running on a track that is built high up above

the street. The tracks rest on steel pillars. The pillars are tall enough so that street cars can run right under the elevated trains. These trains go fast and

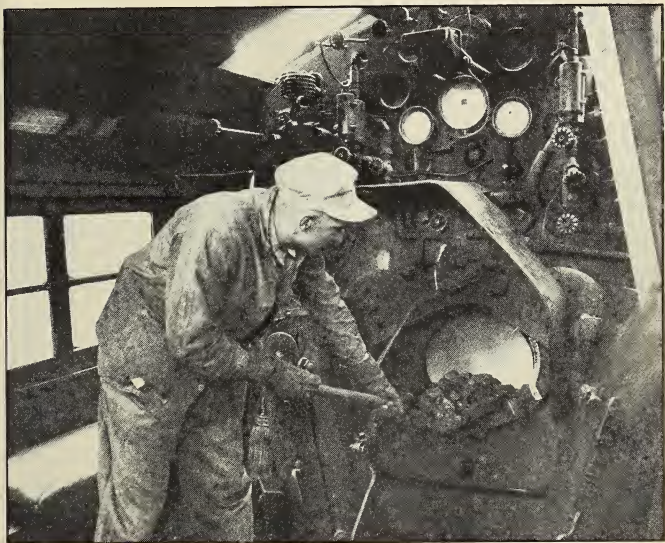


Photo from Ewing Galloway

THE FIREMAN'S JOB IS AN IMPORTANT ONE.

stop only at regular stations. They are driven by electric power. The current is usually carried on what is called the *third rail*. People who ride on these trains go up stairs to the station. Would you like to ride on an elevated train in Chicago, New York, or some city in Europe?

In several cities they have also dug long tunnels under the streets. In these *subways* they have laid tracks. Long electric trains rush through these tunnels and stop at the brightly lighted underground stations. Why do they not use steam cars in the subways?

When a great steam engine drawing a long train goes past us, we may forget the hard work done by the fireman. He shovels coal on the fire that heats the water to make the steam. Besides this the fire makes smoke that often comes into the windows of passenger trains. No one likes this. In cities the smoke from the many steam engines that come and go is disliked by everyone.

Electric power has worked so well on "surface" street cars, elevated trains, and subways that it is beginning to be used on railroads. Several railroad systems use electric locomotives to pull their trains in and out of the cities.

THE ELECTRIC RAILROAD TRAIN

By 1916 the Chicago, Milwaukee, and St. Paul Railroad System was using electric locomotives on long mountain stretches in the states of Washington, Idaho, and Montana. These engines can pull about twice as heavy a load as a steam engine can and can go twice as fast with it.

In Europe electric street cars, subways, and electric locomotives have come to be used almost as much as

they are in our country. Some of the countries in other parts of the world also have them.

This story is only the beginning of the use of electric power. It is only two hundred years since men first

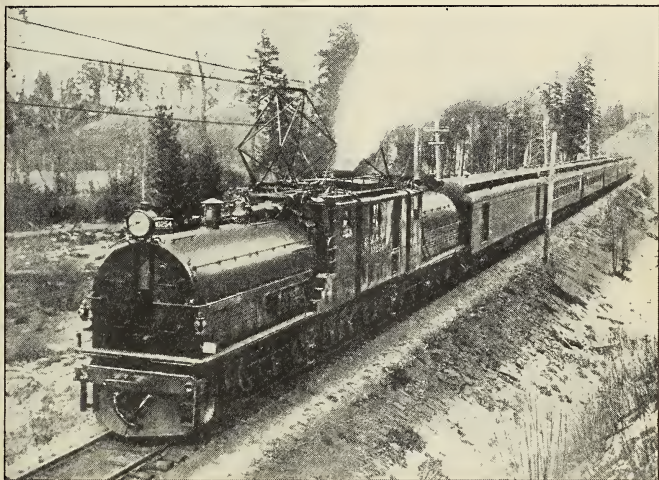


Photo from Ewing Galloway

WATER POWER IN THE WEST HAS GREATLY INCREASED THE USE OF
ELECTRIC LOCOMOTIVES.

began to study electricity. It is only about fifty years since they began to find ways of using it to make work easier and life more comfortable. In what ways does electric power help to make you more comfortable and appier than you would be without it?

MORE TO THINK ABOUT AND DO

1. If you have the book in your library or can borrow it, please ask your teacher or some one older than you are to read and talk over with you Chapter XVII of Gertrude Hartman's *The World We Live in and How It Came to Be*, published by The Macmillan Company.

2. Perhaps you may also have read to you "Trolley Cars, Subways, and Elevated Trains," pp. 232-242, from *Travel by Land, Air, and Sea* by Hanson H. Webster — Houghton Mifflin Co.

3. You will have much to think about now that you have studied about electric cars and trains. What questions do you wish to have some one answer for you?

4. Pretend you are "Electricity." Tell how you have helped transportation.

5. Make a list of the words which people needed after they began to use electric power and which had not been needed before.

6. What do you think we shall use electricity for ten years from now that today we are using other power for?

II. HORSELESS CARRIAGES TRAVEL ON
ROADS

Deep down in the earth, in some parts of almost every country, there are supplies of a thick dark oil called *petroleum*. Back in the days of the Egyptians, Greeks, and Romans, a few people knew about this *rock oil*, as it was then called. This was because,

once in a while, the oil worked its way up to the top of the ground. In America the Indians used this oil as a medicine for rheumatism.

THE STORY OF PETROLEUM

When white settlers came to live in Pennsylvania, they dug wells so as to have water near their homes. Some of them found petroleum in the water. This made them very cross indeed. Why?

After a few years people tried to burn petroleum in lamps in place of whale oil. The petroleum smoked and had an odor. About 1860 a man in our country learned that *kerosene* like that which had already been taken out of coal could also be taken out of petroleum. For what is kerosene used?

About the same time Edwin L. Drake thought of a way to get the petroleum up to the top of the ground. He drove a long pipe little by little down deep into the earth. The oil could be pumped up through the pipe. His was one of the first oil wells in this country. Soon after this many more oil wells were "driven," for men had now found a way to light their homes, streets, and factories with something besides candles or whale-oil lamps.

Kerosene was taken from petroleum by slowly heating the petroleum until a vapor began to come off. The vapor that came off first was not used. As the oil

became hotter the vapor that then rose was caught and cooled. This was kerosene. For some years kerosene was the only part of petroleum that men tried to save for use.

The vapor that came off from the petroleum when it first began to get warm caught fire so easily that no one knew what to do with it. Men tried to burn it up before it did any harm.

Steam engines could not do all the work that men wished them to do. Inventors had been trying for years to make an engine that would be smaller and easier to use than a steam engine. Several such engines had been made and none had worked very well. Each one, however, had been a little better than the one before.

THE COMING OF THE GAS ENGINE

Perhaps the idea for the next engine to be invented came from shooting a gun. The gunpowder "blows up," we say, or *explodes* in the *chamber* — the part just behind the long tube called the *barrel*. This power sends the bullet speeding away.

From France and Germany in 1875 came an engine built on this plan. This engine used an electric spark to explode a small amount of coal gas inside the engine itself. If these explosions happened again and again, the power of them would drive a machine.

At last man had found another way to drive a machine besides using wood or coal in a fire box. He could let tiny explosions inside the engine do the work. It was because electricity helped him also that he was able to do this. This new engine could do what the electric motor could not do. It did not need to get power from a wire or rail. It could be put on wheels and could go anywhere by its own power.

The invention of the gas engine made men look for a cheaper gas than coal gas. Soon some one found this gas. It was in the vapor that came from petroleum before the petroleum was hot enough to give off kerosene. Think of all of this gas that men had thrown away because they did not know how to use it!

This vapor was from then on carefully collected, cooled, and was soon known as *gasoline*. Now more and more petroleum wells were opened up. Gasoline was worth more than kerosene. Why was this? Petroleum first gave us light. Then it gave us power. It gives us many other things too. Do you know what some of these are?

HOW THE AUTOMOBILE WAS INVENTED

There were horseless carriages in Europe long before the gasoline engine had been invented. In 1836 steam-driven carriages ran on the roads and carried passengers. These carriages made regular trips in both England

and France. The carriages were heavy because they carried wood or coal along to keep up the steam.

By 1890 a German inventor had built a carriage with a gasoline engine in it. As soon after this as 1895,



Photo from Ewing Galloway

ONE OF THE EARLY MODELS OF GASOLINE BUGGY

horseless carriages were also being talked about in our country, in England, and in France.

The first automobile races were held about this time. Steam engines, one electric engine, and gasoline engines drove the cars. The gasoline-driven cars won. The

cars went about fifteen miles an hour. In 1893 Henry Ford built his first gasoline-driven automobile. It could go about twenty-five miles an hour.

For a time, about 1896, electric automobiles were built by several companies in our country. An electric automobile is run by electric power from a *storage battery*. If the battery is not strong, the car cannot go very far. The power was often used up in these cars before the driver thought it should be. Then the car would have to be towed to a dynamo to have the battery recharged. Do you see why these cars are not used much today?

DIFFERENT AUTOMOBILES FOR DIFFERENT KINDS OF WORK

We know there are boats to do different kinds of work. There are freight cars built for carrying different kinds of goods. No one person, however, can learn about all the kinds of automobiles we have today because they do so many different kinds of work in so many different places.

In cities some people do not like to have street cars on their streets. They have *auto busses* instead. Large automobiles take people on trips to see a city or a beautiful part of the country. These are called *sight-seeing busses*. Some schools carry pupils to and from their homes in *school busses*.

Motor coaches now make regular trips like railroad trains except that they travel over country roads and through the streets of cities. These are known as *bus lines*. Some of the busses on the very long routes



Photo from Ewing Galloway

MODERN STREET BUSES ARE DISPLACING TROLLEY CARS.

have upper and lower *decks*. The upper deck in these cars is somewhat like a Pullman sleeping car. How would you like to take a trip from New York to California by motor bus?

We must not forget that gasoline engines are found in other machines for travel besides those having four

wheels. The bicycle has been used for years in our country and in other places in the world to take people quickly on short trips. Now, with a gasoline engine in it, it has become the *motorcycle* and carries people



Photo from Ewing Galloway

MODERN LONG-DISTANCE BUSES HAVE ALL THE CONVENIENCES OF A PULLMAN TRAIN.

as far as they wish to go. Besides, it helps policemen to reach any place where they are needed in a very short time. For what else are motorcycles used? What work can they do better than an automobile?

We think, as we read, that gasoline has made great

changes in ways of travel. It has made far greater differences in the transportation of goods quickly, safely, and cheaply.

Instead of horse-drawn wagons' being used to move goods from place to place in cities, the greater part of



Photo by Burton Holmes from Ewing Galloway

TAXIS AND PASSENGER CARS CROWD THE STEETS AT THE SAN FRANCISCO DOCKS.

this work is today in most countries done by motor trucks, motor cars of many different kinds, and even by motorcycles. At early dawn the milkman comes

in a *delivery truck* and leaves the milk on the door-step. Late at night great moving trucks, or vans, pass through the city streets carrying huge loads from one end of the country to the other.



Photo from R. I. Nesmith and Associates

TRAFFIC IS HEAVY IN LONDON'S STREETS.

All day long automobiles built to hold goods drive back and forth on busy streets. Down on the docks and at railway stations large trucks are being loaded and unloaded. *Taxicabs* carry people here and there. Today the gasoline engine has replaced the horse for

most of the transportation in cities. Outside of cities horses still draw loads on the roads. More and more, however, the people who work so hard to raise the food for those who live in cities are using gasoline trucks to take the food to market. What work is left for horses to do?

The first gasoline automobile was sold in our country in 1896. Now between 4,000,000 and 5,000,000 gasoline-driven automobiles of all kinds are made each year.

France and England and Germany have large numbers of automobiles of all types on their streets and roads. We find automobiles today in some parts of almost every country in the world. Sometimes they are the cars of people visiting or traveling through the country. Can you think of some countries where we might not find automobiles?

TRANSPORTATION IS ALWAYS BEING IMPROVED

We have come from early man's use of the two-wheeled cart on which he pulled his few goods to the times in which we live. We have seen how man learned slowly by trying day after day to use wind, fire, and water to help him carry on trade or move his home to a new place.

We know that after he had used steam he learned to use electricity to drive cars or trains on tracks.

Then he found out how to put a storage battery in a wagon so that he could go where he wished as long as the battery would keep on giving out power.

While all this was happening a new engine was invented. This engine made its power with little explosions. Down in the ground was the petroleum which gave the gas to be exploded by a spark of fire made by electricity. Inventors have kept on making steam engines better able to do their work. They have also improved electric motors until they are very powerful. The great automobile companies work night and day to improve the gas engine. They try to make cars for our use and pleasure that are swifter, easier to drive, and cheaper to run than they have ever been before. Is it any wonder that this is called the *speed age*?

We must remember that quick, cheap transportation is just as much needed on water as it is on land. After the gasoline engine had become so useful, it started man to thinking about another way to use petroleum.

THE DIESEL ENGINE

The next great engine to be invented is known as the *Diesel engine*. This invention was first made for ships. It is now being used to pull the new "streamlined" railroad trains. The engine uses petroleum almost as it comes from the ground. The Diesel engine works a little differently from any other engine made before.

Because it burns crude oil it is much cheaper to run than a gasoline engine. We see from this that steam may not always be the cheapest and best power that drives ships across the seas. What are some of the reasons why the Diesel engine will probably be used more and more in ocean-going ships?

HOW BETTER ROADS CAME TO BE

As soon as automobiles came into use in cities, they were desired by people living quite far from cities. Why? As soon as anyone had an "auto," he wished to have good roads so that he could use his car without having to be towed out of mud. What else might happen on poor roads?

The building of roads in all of the great countries of the world is a long story. You will wish some day to find out about the very early roads and how men learned from each other to make them better and better.

Governments help to build roads just as our government helped to built the first railroads to the Far West. The Lincoln Highway, the Yellowstone Trail, and the Dixie Highway are some of the best known roads in our country. What kind of road do you like best to ride upon? What kind of road do you think is most comfortable for horses that draw heavy loads on roads? Why?

MORE TO THINK ABOUT AND DO

1. *The Ways We Travel*, by Frances Carpenter, published by the American Book Company, tells you many more things that you will wish to know about automobiles and roads. Perhaps you can have Chapters 12, 13, and 14 read to you if you cannot read them easily yourself.

2. What does Miss Carpenter tell you about automobiles that your book does not tell?

3. What does Miss Carpenter say about roads?

4. Make five questions about gasoline engines to ask your classmates. Be sure you can answer them yourself.

5. Make a list of other kinds of machines for transportation besides automobiles that are run with gasoline engines.

6. Make a list of the different kinds of work you have seen automobiles do.

7. Play you are living in 1895. Tell about the first automobile you ever saw.

8. Now tell about three different kinds of automobiles that are used all over our country today.

9. What different kinds of engines are told about in this story? Which kind is used the most today? Which one is used least? Why?

10. Is petroleum used in any other way on steamships except in Diesel engines?

III. MAN LEARNS HOW TO FLY THROUGH THE AIR

You have, no doubt, sometimes said to yourself, "The more man has, the more he wants." This is



From an old print

THE BEGINNING OF A BALLOON FLIGHT

true. If it were not for our wants, or desires, probably few of the great inventions we enjoy today would have been made.

Think of the things you have wanted that you did not have. Many times you have been able to find a new way to get them. You are an inventor when you do this. Sometimes the inventions made by people

to please themselves afterward become some of man's greatest helpers. This seems to be true of those who first tried to find a way to travel through the air.

THE FIRST BALLOONS

In the city of Paris in 1783, a large gayly colored balloon lifted itself and sailed up towards the clouds. This balloon was about thirty-five feet across and was filled with heated air. You know that warm air rises above cooler air. The people were so excited over this invention that they raised money for another balloon.

This balloon was made of silk and was filled with *hydrogen*. Hydrogen is a gas that is much lighter than air. It is said that as the balloon went up it was carried along by the wind. Finally it began to come down a few miles from the starting place. The people who saw it come down did not know what it was. They thought it was a great bird and they tried to kill it.

The first balloons sent up in our country were much like those tried in France and in England. James Wilcox of Philadelphia had heard that both animals and men in Europe had gone up in balloons and had come down safely. Mr. Wilcox was willing to try going up. After he was up in the air, he found himself sailing toward a river. In order to come down quickly he cut holes in his balloon. He hurt his wrist in landing, but he had the honor of being the first Ameri-

can to go up in the air. This was also in 1783, only a few months after the first balloon had gone up in Paris.

Two years later two men sailed through the air in a balloon carried by the wind from England across the



Photo from Ewing Galloway

PARACHUTE JUMPING GIVES A THRILL TO THE WATCHER IF NOT TO THE JUMPER.

water to France. A monument has been built where they landed to help people remember what these men did. They were using the wind in a new way to carry them from one place to another.

Perhaps you have seen the *parachutes*, or umbrella-like sails, that men who travel in the air carry with

them. It is believed that parachutes were invented long before balloons were.

The Siamese living in Asia are said to have used small parachutes as playthings. Soon trained people began going up in balloons, jumping from them, and sailing slowly and safely to the earth with the help of parachutes. This was done at fairs and at other holiday celebrations.

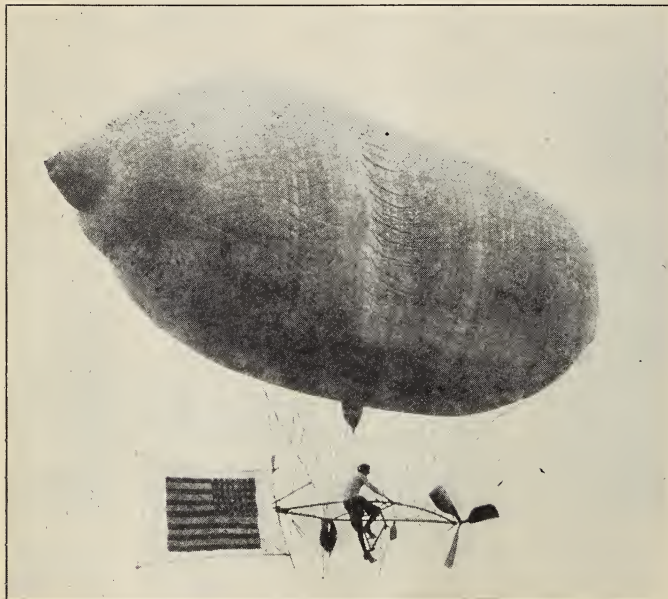
THE DIRIGIBLES

The balloon seemed to be helpful in a few ways but it did not satisfy man's desire to travel in the air. It could not be made to go where man wanted it to go. About 1850 a Frenchman put a steam engine under a cigar-shaped balloon. He used the engine to turn a screw propeller. There was also a rudder with which to steer the airship. Can you imagine this great boat-shaped bag up in the air? It was driven ahead by a propeller and was steered with a rudder just as a boat is. What do you think the people of that day thought when they heard and saw this great ship coming through the air?

As time went on, the gasoline engine was used in all of the airships made. This was because the engine and the gas to burn in it were lighter to carry than steam engines burning wood or coal.

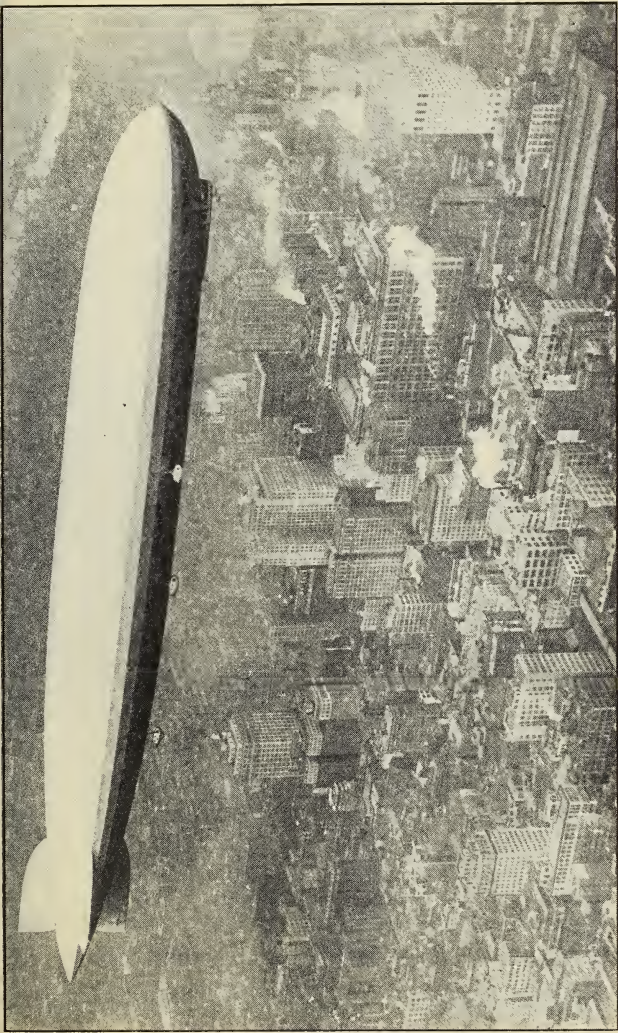
Inventors in the different countries were trying in

different ways to make airships safer and more easily managed. Each inventor wished to build an airship that would make regular trips through the air to carry



EARLY TYPE OF A DIRIGIBLE DRIVEN BY MAN POWER

people from place to place. One of the men who did much to improve the balloon kind of airship was Santos-Dumont from South America. He sailed over Paris in 1901.



From Wide World Photos

THE Graf Zeppelin FLYING OVER PHILADELPHIA

THE FIRST ZEPPELINS

In 1909 the *Zeppelin III* made a trip over a lake in Europe. The ship carried twenty-six passengers. Count Zeppelin of Germany was the builder. He used what is called a "rigid" ship. A light metal framework was first built. This was covered with very thin strong metal. The gas was carried in bags inside of this covering. The Zeppelin is the kind of airship that is being most used for transportation.

Since 1909 each of the great nations has spent much money in trying to make airships that will carry out the desires of their inventors. They now use *helium* in most airships instead of hydrogen. Helium will not burn. Why is this gas safer to use?

During the past few years a few great airships have gone across oceans.

The huge *Graf Zeppelin* was built in Germany. It is 770 feet long. It has sailed around the northern part of the world. It has also made other trips from Germany to the United States. It can carry sixty passengers besides the workers on the ship. You will wish to read about the improvements that are day by day being made in these ships. What are some of the things airship builders have not yet been able to do? Why are these ships often called Zeppelins?

At the end of a journey men found it very hard at times to put these great airships inside of their build-

ings, called *hangars*. Why was this? Now a tall strong pole, or *mooring mast*, is set up where airships land. One end of the ship is tied to this pole. Why is this a better way to land an airship than trying to put it inside of a building? When can an airship be put into its hangar?

THE FIRST AIRPLANES

We believe that the very earliest ideas men had of traveling through the air came from watching the way that birds fly. There is a story about the artist Leonardo da Vinci. They say he made some wings for himself that he worked with his arms and legs. That was about the time that Christopher Columbus lived. It was almost three hundred years before the first balloons went up in Paris.

Another way of flying that was tried for years used wings that did not move. A flier sailed, or *glided*, in the air as a leaf floats down from a tree. The wind helped these gliders to keep on going.

Along with the gliders came the kites. Laurence Hargrave of Australia built four box kites. He tied these one above the other with strong cords. He sat in a seat under the bottom kite. People had for years and years flown kites. If kites would fly, why should they not carry man up with them? Why do you think kites did not long satisfy man's desire to fly?

All these ideas were used by the later inventors. Gliders seemed to work best. The Wright brothers, of Dayton, Ohio, were trying their flat gliders. They had



Photo from Brown Bros.

WILBUR WRIGHT DRIVING ONE OF THE FIRST WRIGHT PLANES

added a rudder for steering and an extra little board in front to help them go up and down.

Others had used gasoline engines to drive their planes where they wished them to go. Inventors in many of the great countries of the world were trying over and over to make airplanes that would be more useful than the great balloonlike airships that they had by this time heard about or had seen.

These thinking men knew that great airships could never do many things that small, quick airplanes could do. They tried hard to invent planes that would work well. English, French, Germans, and men in other countries kept on making improvements. In our own country several inventors had been at work with gliders and gasoline engines. One of these to be remembered is Samuel Langley, who made the first short flight.

In 1903 Orville and Wilbur Wright made the first successful American airplane. Santos-Dumont, who, you remember, worked on airships, was also trying to improve airplanes. He made one of the first airplane flights in Europe in 1906.

In 1908, Wilbur Wright took his plane to France where he stayed in the air for more than two hours. At last man had learned to fly.

From that time until today men have been at work in all parts of the world trying to make airplanes safe, cheap, and easy to run. These planes will in time, they think, do much of man's work that is now done on the land or water by steamships, trains, busses, large and small trucks of all kinds, and pleasure cars. Do you think you will see this happen?

DIFFERENT AIRPLANES FOR DIFFERENT WORK

Just as there are different kinds of automobiles to do different kinds of work, so there are different kinds of

airplanes. Each kind has been built for power. Some airplanes need speed power. Others need lifting power. Inventors try to get both of these in one plane if they can.

If a machine uses up a large part of its power in just moving itself along, it cannot carry a very heavy load of goods. This is one of the reasons why airplane routes must be planned carefully. The planes must have places to land and to take on more gasoline. Why is this?

Both biplanes and monoplanes are used for the different kinds of transportation. A biplane is a plane that has two pairs of wings, one above the other. A monoplane has only one pair of wings. The body, or *fuselage*, is between the wings. It is smooth and pointed at each end. The fuselage is built in different ways to suit the work that any one plane is to do.

To keep a plane from tipping from side to side in the air, *aileron*s are used. These are little wings near the ends of the large wings. The pilot can tip these little wings up or down as he needs to do, to keep his plane from traveling sideways or even bottom side up.

An airplane pilot must steer with the rudder towards the place he wishes to go. This he does with his feet or with a wheel. To go higher or lower, the pilot pulls a "stick" back or pushes it forward, or uses a steering wheel. As he goes along he must keep the

plane steady by moving the ailerons. Besides all this he must see that the engine has enough gasoline and is working just right.



Photo from R. I. Nesmith and Associates

THE COCKPIT OF THE CARIBBEAN CLIPPER ON ITS WAY FROM PUERTO RICO TO MIAMI

There are many other things to know about airplanes. Most of them are now made of light metal. Wooden wings are found on some of the smaller planes. Wings are also made of light frames covered with strong thin cloth.

AIRPLANE ROUTES

The pilot must have a way of knowing where he is going in the night or if he is caught in a fog. The in-

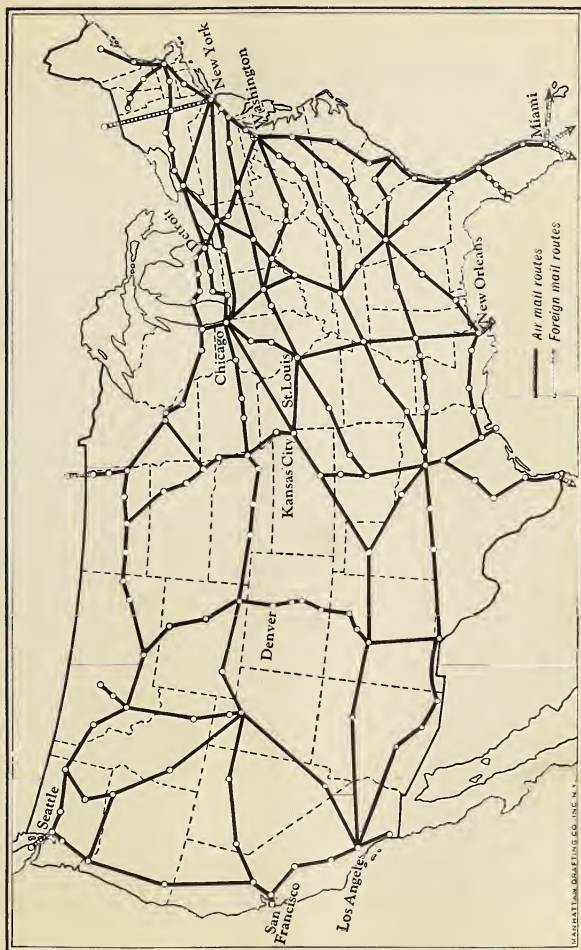
vention of the *radio* gave this much needed help. Now the pilot can talk to people on the ground. Besides this a *radio beacon* tells him in cloudy weather whether he is to the right or to the left of where he should be. In clear weather he is guided at night by beacons like seashore lighthouses.

Perhaps the first work done by airplanes that helped man most was the carrying of mail. In 1918 the first letters were sent by air in this country. In 1924 air-mail routes reached from San Francisco to New York. This trip was then made in thirty-five hours going west and in thirty-two hours going east. Can you find out why there was a difference in the time needed for these trips?

Along the way are strong lights that show the pilots the route. There are landing fields every twenty-five or thirty miles that can be used if there is trouble. There are regular, brightly lighted landing fields every two hundred fifty miles. What are some of the differences between these two kinds of fields?

Soon after air-mail service was started in different countries of the world, people wished to ride with the pilots. This was the beginning of passenger service. Planes were next built with several seats in the body of the plane. These were much like the seats in an automobile.

More and more people bought and learned to pilot



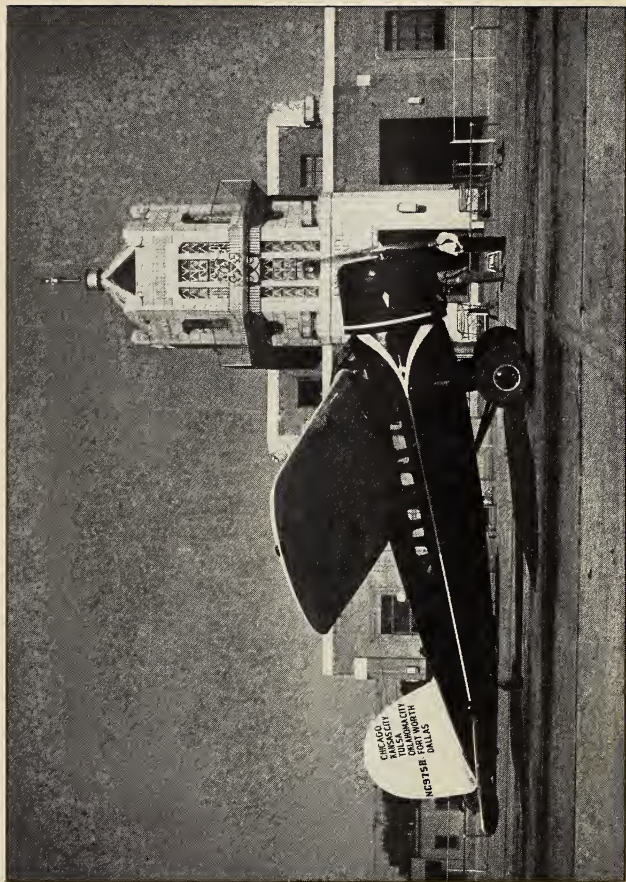


Photo by Charles Phelps Cushing from R. I. Nesmith and Associates

THE KANSAS CITY MUNICIPAL AIRPORT

their own planes just for the sake of trying to do something new. The idea of air travel was also pleasing to those who could not own a plane.

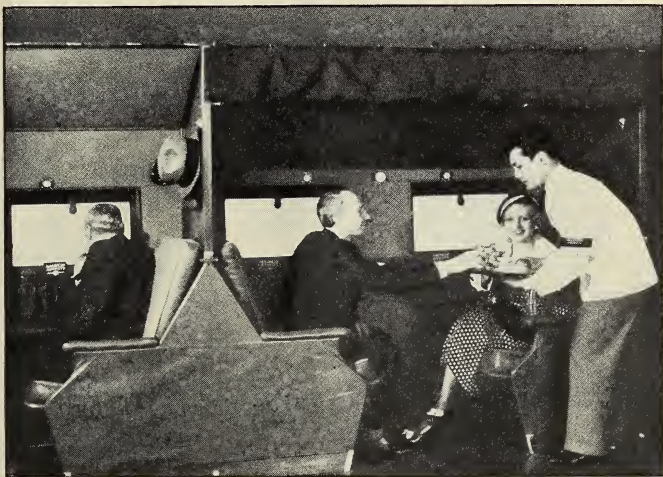


Photo from R. I. Nesmith and Associates

CABIN OF A CURTISS-WRIGHT CONDOR PLANE

Soon large companies began to build larger passenger planes that were as comfortable as Pullman coaches. This was done in Europe before it was done in our country. Now there are passenger planes carrying from eight to forty people, each making regular trips in many countries of the world. How do you think these planes differ from planes for mail only? The

Do-X is one of the largest airplanes ever built. It is a German plane. It is called a seaplane because it is built to land in water safely. Why is this helpful?

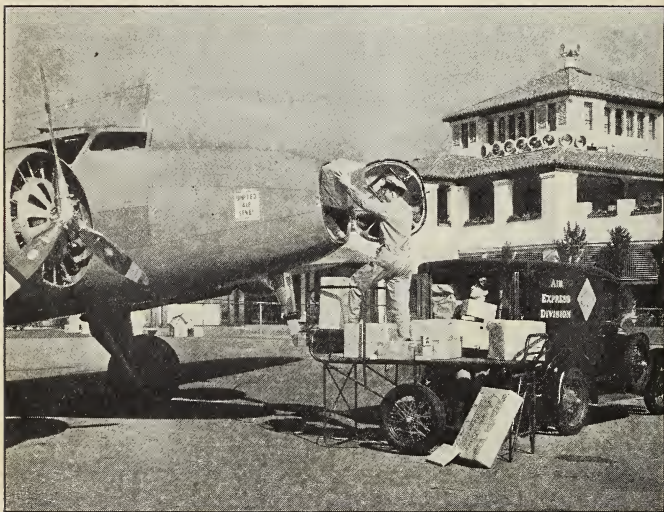


Photo from Brown Bros.

EXPRESS PACKAGES TRAVEL FROM COAST TO COAST IN A SINGLE NIGHT WHEN CARRIED BY PLANE.

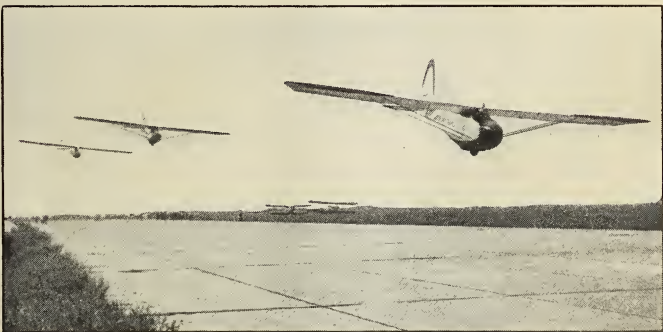
GROWTH OF TRANSPORTATION BY AIR

Today landing fields are almost as often seen as railway stations. Airports are found in the large cities all over the world.

The gasoline engine helped to give us the airship and the airplane. Planes are now being built, however,

that are driven by Diesel engines. You remember the Diesel engine really burns whole petroleum inside the engine itself. It does not run by explosions of gasoline. This makes the Diesel engine safer and cheaper. Besides, the electric spark needed in the gasoline engine sometimes interferes with the radio in the airplane. What do you think will be the next great improvement in airplanes?

Air mail, air express, and air-travel routes are now working together in great air transportation systems. Airplanes carry people and light-weight goods almost anywhere in the world. They can reach places where there are no roads. They can go where there are no railroads or steamship lines. They can carry goods to



Wide World Photos

THIS SUGGESTS ONE OF THE ANSWERS TO THE QUESTION AT THE END OF THIS PARAGRAPH. IT SHOWS A "SKY TRAIN," OR AIRPLANE TOWING TWO LOADED GLIDERS.

the hot lands and to the cold lands. Some of them can land safely on the water. Most wonderful of all, they can go faster than any other machine. The great passenger planes today go more than twice as fast as the mail planes did in 1918. What changes in transportation do you think we shall see during the next ten years? Why?

MORE TO THINK ABOUT AND DO

1. You have many pictures of all kinds of transportation that you have been gathering while you have been studying how goods and people go from place to place. Would you like to make a scrapbook of these showing "land transportation," "water transportation," and "air transportation"? Can you put these pictures in your book so that they also tell the story from long ago to now for each of these kinds of transportation?

2. Find as many stories as you can in your readers and other library books about transportation.

3. Can you find out something about the men and women who flew across oceans just to prove that it could be done?

4. Perhaps you will wish to listen to your teacher or to some one else who will read to you "Conquering the Air," Chapter XXI, pages 317-336, from Gertrude Hartman's *The World We Live in* — The Macmillan Company.

5. Choose and work out a plan for telling other

classes and your parents about the story of transportation.

6. Probably you will be able to read *America Travels* by Alice Dalgliesh — The Macmillan Company. This book will make you feel that you are taking trips all by yourself.

7. Perhaps you can also read *Big Fellow at Work* by Dorothy Baruch — Harper and Brothers.

DO YOU KNOW THE ANSWERS TO THESE QUESTIONS ?

1. How does man's invention of the wheel help us today?

2. What has coal done to help man?

3. Who invented the steam engine?

4. What work that man once did by hand does steam do for men today?

5. Who are some of the men who studied hard for years to learn about electricity?

6. What does electricity do for us that men or animals once did?

7. In what ways do air and wind help us?

8. What has petroleum done for us?

9. Who are some of the men who in the last fifty years by discovery or invention have helped us to have things from all over the world to use and to enjoy?

10. Who are some of those who have made air travel quick and pleasant?

11. What do you think the next great discoveries or inventions may be?

UNIT EIGHT. COMMUNICATION TODAY AND VERY LONG AGO

I. WHAT COMMUNICATION IS

Soon after we are awake in the morning, we may hear some one say, "Come to breakfast." As we go about getting ready for school, there are things to talk about and things to hear that others say. From then until we say, "Good night," if we are not all alone, we are talking with other people much of the time.

Out on the city street we will watch the *Stop and Go* signs. They may be different-colored lights or pointing arms or just the words "Stop" or "Go." Perhaps, instead, a policeman will tell us when to go and when to wait. He may use his arms to do this.

If we live outside a city and walk or ride to school, we pass *markers* along the roadside. These tell the number or name of the highway to anyone who does not know it. At crossroads the signboards tell strangers which way to go to get to the places named on the signboards.

Before the day is over, the mail will come. There may be letters, newspapers, catalogs, or samples of something to use, in the morning or afternoon mail.

At school we use books, maps, and pictures. We write and draw things. We tell about things that happen. Perhaps the teacher may be called to the

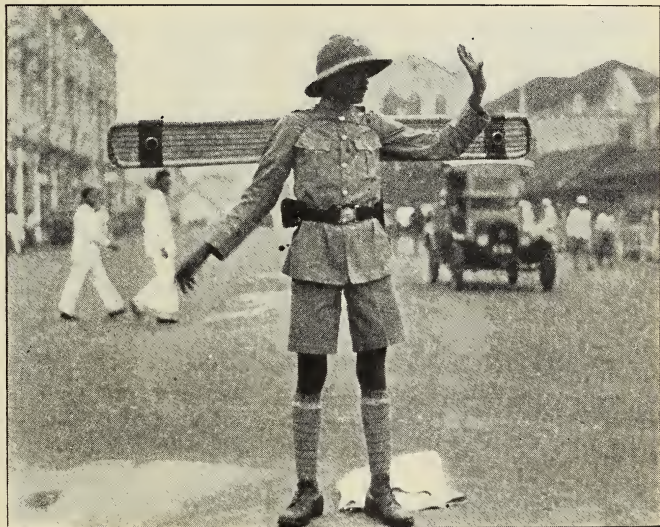


Photo by Harry Drucker from R. I. Nesmith and Associates

TRAFFIC POLICEMEN ARE FOUND IN CITIES THE WORLD OVER

telephone. If there is a *radio* at school, we can listen to beautiful music or hear some one talk. Then a bell rings to tell us that school is out.

In just one day or even in a small part of a day you see we use many different ways of telling others our thoughts or our wishes and of finding out from others

what we need to know. We call this *communication*. We communicate with one another by talking, by signs or signals, through letters, books, newspapers, and pictures. Can you think of other ways?

What a strange world ours would seem if all of the ways of communicating were taken away from us! We do not like it if the telephone is out of order for one day. That is only one way of communicating. Think of all the other ways of communicating that we have.

From our study of transportation we have learned that early man had only trees, rocks, water, animals, and fire to help him find ways to get food, clothing, and a home.

Did you ever try to think how these very early people first learned to tell one another their thoughts by means of spoken words? There was, of course, no one to teach them because no one knew any words.

When was the first signal invented? Who wrote the first letter? When and how was the first book made? Who was the first person who thought about talking over a wire? How did radio come about?

These are some of the questions you will be able to answer when you have finished this book. You will also understand better how there came to be different ways of talking and writing in different parts of the world.

MORE TO THINK ABOUT AND DO

1. Make a list of all the people to whom you have talked since yesterday.
2. List the people who have talked to you.
3. Have you made use of any signs? What were they?
4. What uses have you made of writing?
5. Have you read anything? List the newspapers, books, or magazines you have read.
6. Do you think animals communicate? What makes you think so? How do they do it?
7. Do we communicate with animals? How do we do it?
8. Do animals and birds communicate with us? How do they do this?
9. Have you used any other kinds of communication? What were they?
10. You will wish, no doubt, to make a large collection of pictures of all kinds of communication. You will need another envelope in which to keep your pictures.

II. HOW EARLY MAN LEARNED TO TALK

No one knows just how early man learned to talk. Many people have wished very much to know this. They have studied for years to try to find out. They have gone to many of the places where it is known that very early people lived. They have also tried another way of finding out. This is by studying how some peoples are living today.

There are still places in the world where there is hardly any trade with other countries. In these places we know that people live today very much as all the very-long-ago people lived.

This is because these tribes even now know how to do only what they have learned by themselves. They have not had a chance to see or hear how other people do things. Most of these people live in the very hot countries. They are not often cold or hungry. They do not need to try very hard to get food, clothing, and a place to live. That is the reason why they have not learned more.

THE FIRST SOUNDS AND SIGNS

We say these people are *primitive people* because they are still like the very early peoples of long ago. Men have learned how some of these primitive peoples talk to each other. By bringing together all that can be learned in both of these ways we are able to tell very nearly how the people who lived before us learned to talk.

Most of us have heard a little child say "choo, choo" for train. Many believe that the first words man used were much like that. You see, man had no words until he made them. He could not talk at all as we think of talking. We think he must have pointed to things at first because we are sure he would never have learned

to talk if he had not wished very much to communicate. His need to make some one know his thoughts helped him to learn. Pointing to things was not very useful.



Courtesy Curtis and Cameron

PRIMITIVE MAN BUILDING A CAIRN, OR MOUND OF STONES, TO SERVE
AS A REMINDER OF AN IMPORTANT HAPPENING

From a painting by John W. Alexander in the Library of Congress,
Washington

Unless the things were always there, man could not make anyone else understand.

Making motions with the hands was a little better, but there are only a few things that can be said with motions. Try to say "tree" with your hands. You

can think of other things that the motion you make for "tree" could just as well mean. Motions did not help man much, but motions or signs were better than nothing at all. There are some primitive tribes living today that use motion or sign language. These people must keep a bright camp fire at night so that they can see each other's signs. That is, they see each other talk instead of hearing each other.

So far as we know the only sounds that earliest man made which told people anything were laughing and crying. What would those sounds tell others? Because he could not be happy without sharing his thoughts and feelings with other people, he kept on trying different ways to do this.

THE FIRST WORDS

Some think that he first made queer noises when he was hurt. Others believe that man learned to make singing sounds first. Most people think that he finally made rather long noises more like grunts to mean such things as "big animal coming."

Each time he wanted to tell his wife this he made the same sound. After a while the wife made that sound when she wished to tell her husband the same thing. The children learned that sound and what it meant. The people of that tribe soon learned what to look for when they heard that sound. In this way sounds came

to have meaning. Each sound had to be tried over and over until all the tribe knew it.

The next thing that happened, we believe, was this. Man learned to make short sounds for the things which he had pointed to before. He must have had sounds or words for such things as sun, moon, water, fire, tree, meat. Now he could make people think about those things at times when they could not see the things.

Man had now taken another long step forward. He could make a sound that made other people think of the same thing he was thinking about when the thing was not there. Of course, he had only a very few words because he used them only for things that he could see or touch.

We do not know just how man learned to make sounds that meant such things as "run," "walk," "drink," "eat," "carry," "do." He had these words after a while and then he was able to communicate much better than before. By putting two or three sounds together a father could make his child know that the child was to "go with him" or to "stay with mother." Before that he could tell the child only with motions. Man had now learned to use words in different ways.

We must remember that very early man did not need a great number of words. He did not have many things to name. He did only a few different things in

any one day. He would, however, need those words very much.

Have you ever tried to get along without talking for an hour? How many things you wished to tell to others in that time! Can you not see that early man in all but a few places found words so helpful that he kept trying and trying until he could use them?

From all that we can learn, man's early words were much like the "bow, wow" that means dog for the baby. He may have used the sounds things made for names for those things. He seems to have also used some part of the body or something different about each of the kinds of animals to name them.

We do not know how long it was before man began to give each person in his family a name. Those who have studied early man's ways say that he sometimes used the color of the eyes or hair for a name. Some grown-up people were called by names that told what they could do. Others were named from things that had happened to them. Some had names of things in nature.

Very slowly you see one sound came to stand for one thing or person and another sound for another. Different sounds meant different things to do. This took years and years. There are tribes of primitive people, living today in out-of-the-way places, who know only five hundred different words in all. Do you know how many different words you use in just one day?

We now have learned that even though very early man had no words with which to talk he did not live alone. He liked to be with other people. Soon he found that working together was better than working alone. If men were going to work together, they must think together. They must have ways to communicate.

Man tried one way and then another to find a way to share his thoughts with others. Sounds seemed best. He and those around him slowly learned some sounds that meant the same thing to them all.

When early man first learned to make sounds that named things, it gave him more chances to share his thoughts with other people in his own tribe. When he learned words for doing things, he could then work much better with other people. This was the beginning of man's upward climb from long ago to now.

MORE TO THINK ABOUT AND DO

1. Think of the things that early man would wish to name with sounds. Make a list of our words for those things.

2. Think of the things early man and his family would do in a day. Make a list of our words that would tell what they did.

3. Try making up a language that you and only one or two other children can understand. Talk a few minutes each day in your new language. What does this tell you about how early man learned to talk?

4. Make up a list of names of people that might live in an early tribe. Keep the men's, the women's, and the children's names in three separate lists.

5. Do we ever use sign or motion language today? Where is it used?

6. Do you know any words that we use today that sound like the things they name?

7. Can you think of any of our words that name something by what it does or how it looks?

8. Watch a little child learning to talk to see how hard it tries to make others understand. What does that tell us about people everywhere?

III. HOW LANGUAGE GREW

We have read how early man is thought to have begun to build up a way of talking. He had begun to have words that named the things people could do. He had words that named people and the things people had around them. This, however, was not yet very useful language. It was only the very beginning of language. Can you tell why?

As soon as man learned new words, he had more ways of sharing ideas with others. He could then use not only his own ideas but those he could get by listening to the words and watching the signs of others. This is the way men learned to think and to study how to do things together.

As man talked about more and more things, he

needed other kinds of words. He needed words like our words "on," "above," "below," "up," "down." How do you suppose he gave these ideas to others before he had such words?

As men became able to speak in sentences and to understand others who spoke to them in sentences, they could not only work together but they could also think together. The more they thought together, the more they wanted to say just exactly what they were thinking.

Then they must have needed and learned to use words that tell more about how things are done, like our words "quickly" or "slowly." They needed words to say what our words like "yesterday" or "tomorrow" tell. They needed words that mean what our words like "here," "there," or "anywhere" mean.

Besides these they soon needed words that told more about what things were like, such as our words "sweet," "sour," "cold," or "hot."

After a while, we think they became tired of always saying people's names every time they wished to talk about them or of saying their own names when they wished to tell what they had done. Then such words as our words "I," "you," "he," and "she" came to be.

You will have an idea of how slowly this all came about when you remember that every one of these sounds had to build up its own meaning by being used

in a family and then by a tribe. When people can speak their thoughts quite clearly and have words for a large number of ideas, they may be said to have a *spoken language*.

HOW DIFFERENT LANGUAGES CAME TO BE

You remember that early man sometimes found that there was not enough food in one place for all the people in a tribe. Then all or part of the tribe moved to a new place. Sometimes just a few families moved away. These families of course could all speak the same language when they lived together.

You have now seen how new words were slowly being added to the language of these early people. As soon as a tribe divided, the new words that were added afterward would be different. After a while their languages would be less and less alike.

We call languages that have become different in this way *dialects*. There are many countries in the world today in which people in different parts of the country have different words for some things and the same words for others.

You have learned that after man had better ways of traveling and of carrying goods he went farther and farther away to trade. In order to carry on this trade, some of the traders learned some words of the languages of other traders.

When each one went back to his home he began using the new words he had learned. This is another way in which the language of any tribe or country came to have more and more words.

People in trying to tell just how they felt or just what they had seen began to use words in different ways and to make new words almost like others they had used before. In this way sentences became longer. People who were together all the time and talked with each other often could probably remember the words and what they meant. What would they do if they forgot?

There were parts of the world, however, so far apart that in those days the people living in one country did not know about the people living in the other. When, after years and years, these people met, they could not talk with one another except with signs. Why was this?

MORE TO THINK ABOUT AND DO

1. Suppose you try to tell some one something and use only the two kinds of words early man had at first. How much did you use signs or motions along with your talking? Why did you do this?
2. Can you think of some of the first sentences early man may have used? Suppose you write as many of these as you have time to write.
3. What are some of the things we talk about today

that the boys and girls of long ago who were just learning to talk would also be talking about?

4. What are some of the things we talk about for which they did not need any words?

5. Do you think the grown-up people of those days told stories to the children? Why?

6. Do you think the children of those days sang songs? Why?

7. Could Columbus talk with the Indians when he landed on San Salvador? Did he use words or signs? Why?

8. How many different languages can you name?

9. Can you speak more than one language?

10. How did different languages come to be?

UNIT NINE. EARLY MAN COMMUNICATED WITH PEOPLE TOO FAR AWAY TO HEAR HIS VOICE











I. THE FIRST MESSAGES

We know that the early tribes of people soon grew too large to get food near their homes. Then they moved farther and farther apart. This gave each family more land for hunting. It also gave the tame animals more good grass land.

When tribes were scattered over the country in this way, they often needed to come together quickly. They were always in danger of being robbed by other tribes. Sometimes wild animals came too near. They also needed to meet to decide on rules or laws for the tribe. Can you think of other things that they might wish the whole tribe to know at the same time?

BEACON FIRES

These early people found a way of sending messages. It was so useful that it has come on down through the years. They used the *beacon fire*. A beacon fire is a fire built on the highest ground that can be found, so that it can be seen for a long distance. One fire meant one thing. Two fires meant something else, and so on.

The Indians in our country also used beacon fires to send messages to other Indians or to whole tribes. They built  to say, "The camp is here."   said, "I am lost."    told "good news."     gave the call to come together.

The American Indian also used fire in another way for daytime signals. He built a fire that would burn with much smoke. He waved a blanket to make the smoke rise in one big puff after another. The way the puffs came told the message. At night Indians sometimes shot arrows of fire into the air to send messages.

It is said that the Greeks once used beacon fires to tell the people that a great war had ended. In our country beacon fires were used during the time of George Washington to tell his soldiers what to do. "Mount Beacon" on the Hudson River in New York State was so named because of this.

THE TOM-TOM, RUNNERS, AND WATCH TOWERS

Among the first things man made for his own enjoyment was a drum. He may have found out about the deep pleasant sound by pounding on a hollow log. Soon, we believe, man beat in regular time. Before long the *tom-tom*, or *tam-tam*, had been made. It was used to keep time for the dance around the camp fire.

Then the tom-tom was made larger. It gave a deeper, louder sound when beaten with the hand or



BEACON FIRES

with a drumstick. Some tom-toms can be heard for miles even through the woods. Today in eastern Africa the primitive people listen for the tom-tom.



Photo from Ewing Galloway

TOM-TOMS ARE THE WIRELESS TELEGRAPHS OF THE NATIVES OF UGANDA,
BRITISH EAST AFRICA.

They can tell what the message is by the way the tom-tom is beaten.

Another way of sending messages in early days was by having the swiftest runner go from tribe to tribe or from city to city and tell the news. It was a great

honor to be a runner. Young men ran more than a hundred miles and were very proud to be able to do it. We know that the Greeks, the Romans, and the Indians in South America sent messages by runners.

In some countries, long ago, one runner went part way, and then he told the message to another runner. In this way a line of runners was always ready to take messages from one city to another.

Often people who were sending messages did not want the message known to the runners. Then a knotted string or a notched stick was sent by the runner. These had meanings for the ones who got them. Can you tell how this might be?

When a message did not need to go a long way, some early inventor found another way of telling it. Alexander the Great, a powerful ruler of ancient times, used this invention. No doubt you have all seen one. It was a huge *megaphone*. Perhaps you have made one out of a newspaper. You have heard them used at fairs or at other gatherings. The one that Alexander the Great had was very large and words shouted into it could be heard a long way off.

Many were the messages in days gone by that went from the great towers called *watch towers*. These towers were near enough to each other so that lights at night or flags in the daytime could be seen from one tower to the next.



Photo by J. V. D. Bucher from R. I. Nesmith and Associates

WATCH AND SIGNAL TOWERS ON THE GREAT WALL OF CHINA

Long, long ago towers of this kind were built every few hundred yards in the Great Wall of China. They were also built by the Romans to send messages to the people all over their land. Can you think of any ways in which we use this same idea today?

We know that primitive man sometimes left his home and went out into the woods to hunt or to find a better place to live. We know that sometimes he did not come back. Why?

He saw that he had need for another kind of message. It was one that would tell him or anyone who followed him just what the road markers today tell us.

EARLY TRAIL MARKING

Early man had several ways of leaving these messages for those who would follow. He also used them to help him go back the way he came. We can learn much about how this was done by studying how the American Indians did it.

As an Indian went along a new way, he cut off a bit of the bark from the trunk of the tallest trees he saw. By making different kinds of cuts he said different things. If there were stones along the way and no trees, he might use them instead. He would pile them in ways known to him and to his tribe to tell in which direction he was going.

If there were neither trees nor stones, he might tie

knots in tall grass to show the way. Another plan was to stick small branches in the ground, leaning the way he was going. Sometimes the branches were laid on the ground with the stem end toward the way the trail lay.

Some of our American Indians also used the trunk of a young tree to bear a message. It was stuck in the



MARKING A TRAIL

ground and was made to lean the way that the Indian was going. Other smaller sticks standing straight up along the sides of this slanting stick told how many

days' journey the Indian had already come. Why did he try to show this on his trail marker?

We probably think that these were not very good ways of sending messages. We must remember, however, that early peoples invented many things that we still use. Besides this we must remember that people in those days learned almost all they knew by trying first one thing and then another until some way was found that was better than the others. All this they gladly gave to those who came later. Men have found many of these early ways of sending messages very useful for some things.

Railroad men use flags and lights to tell each other how to run their trains safely and quickly. The red and green lights we see along the railroad tracks at night are telling the engineer and trainmen things that they need to know.

Lighthouses along the seacoast are often called *beacon lights*. They tell the ships that they are near the shore. Different lighthouses have different kinds of lights. Some shine steadily and others give out flashes so that sailors can tell them apart. The sailors carry charts that tell how each light shines.

Have you ever heard a foghorn? Ships use foghorns when it is very stormy or foggy. The horn blows every few minutes. This tells any other ship to be careful or the ships may run into each other.

There are foghorns on the seacoast to tell ships that they are near the shore. When would foghorns on the shores be used? Perhaps the foghorn came to us from the early days. From which of the early ways of sending messages might it have come?

Today we hear automobile horns, train whistles, factory and fire whistles. We see flags telling what men think the weather is going to be for that day. All of these and many others have come to us from the early days when there were no other ways of communicating.

MORE TO THINK ABOUT AND DO

1. Try to think of all the kinds of messages you have had in one day. How did these messages come to you?

2. What differences would it have made to you if you could not have had these messages?

3. Pretend you are living in the days when they had runners. What did you do when you saw a runner coming? Did a new runner go on from where you live? How long did it take the runners to change? What did the runner who came do after the other runner left?

4. Have you ever played with a mirror in the sunlight? Some long-ago people sent signals by using sunlight. Can you do it? What do you think they used instead of mirrors?

5. Can you make up a set of messages that could be told with not more than four lights in a tower?

Try to make up the messages you think the early people sent from their towers. Show how you would place the lights for each one.

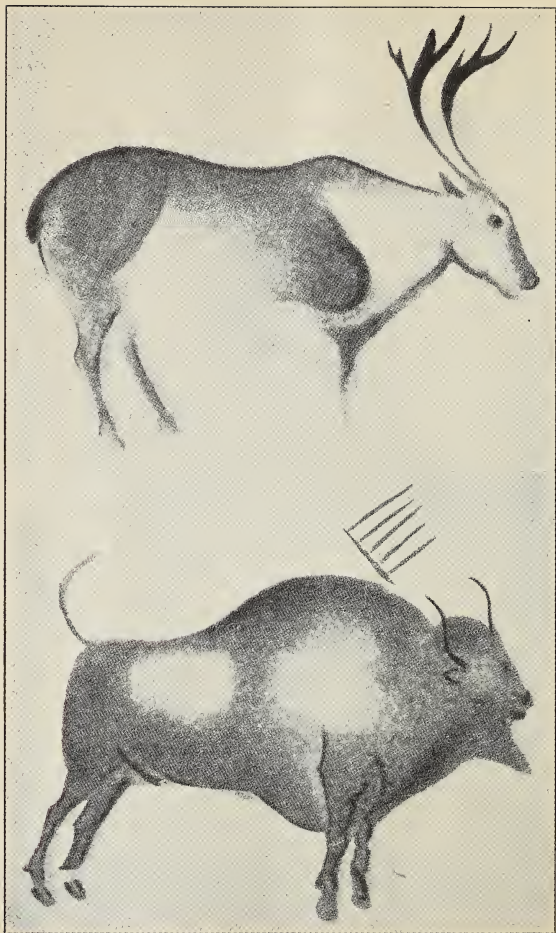
6. Would you like to invent some ways of marking a path through the woods the next time you have a chance? Can you find better ways to do it than the Indians used?

II. MAN LEARNS HIS A B C's

We know that man learned after a time that spoken words did not satisfy all of his needs. He must have ways of talking to people who were far away. He had used runners and he had sent messages by fire and smoke. He had invented the string and the notched stick to send secret messages.

We are told that knotted strings gave some one the idea of using knots to stand for people. In this way some tribes kept a *record* of the number of men, women, and children who belonged to their tribe. How do you think they may have done this?

We know that records are very carefully kept nowadays. The teacher has a record book. People keep records of the money they earn and spend. Our government must keep records. All of the business of the world depends on records. The books we use are also records of what people have thought and have done from the very early times.



DRAWINGS MADE BY EARLY MEN ON THE WALLS OF A
CAVE IN SPAIN

RECORDS OF LONG AGO

We are studying now about the first records that were ever made. Men soon found that knots in cord or even notches on wooden sticks were poor records. This was because no one could remember for very many years what the knots or notches meant. They then used string of different colors to help them. Still they could not remember always what the colors had meant so these records were soon useless.

While very early man still lived in caves, he had begun to make brightly colored pictures on the walls inside the cave. He drew the animals that he used for food. Sometimes these pictures were scratched on bone knives or on other things that early man used. Men also drew pictures of horses and people riding upon them.

Then they began to make drawings that told things that happened. Perhaps they would make a picture of a hunt. It would show the man shooting and the animal with an arrow in its side. These were the first records made by men that people living in later years could understand. This is because these records show the things that happened. How are these records different from knots in a string?

Men found these pictures very useful. They could draw picture stories of what they hoped would happen. These were pictures of what they were thinking. Some

of these pictures are the first records we have of what early man thought.

There are a good many pictures and small bone or stone carvings in the places where these primitive people lived. What else can we learn about the long-ago people from their first records?

The next improvement early man made in his keeping of records was to draw a picture for each word. Then his record would be more like a story that would mean just the same thing to each person who could understand the words. These were more truthful records, as you can easily see. Not everyone, however, could draw well enough to have his picture words read easily. Besides it took ever so long to make the pictures.

Man saw that he needed a quicker and easier way of keeping records and of telling his thoughts. Many people tried hard to find a plan that would help. Then a way was found which helped very much. Instead of drawing whole pictures for each word they drew parts of pictures.

That is, if an animal had been killed in the hunt, they would not draw the whole picture for each word in the story. They might draw the arm of the man, the head of the arrow, and the spot where it hit in the animal.

This was a great improvement because it saved time and was easier to do. Man, however, found a still better way.

PICTURE WRITING AND SIGNS

Very simple pictures were used to mean bigger ideas than the pictures alone showed. That is, the picture of a moon and star would stand for "night." A big sun would stand for "day." This made picture writing



Courtesy Curtis and Cameron

PICTURE WRITING BY AMERICAN INDIANS

From a painting by Frederic Remington

mean still more. Yet it did not satisfy man. Some one was soon trying to find a still easier and shorter way of keeping records.

The next change came when man made his pictures stand for sounds of words instead of for ideas.

If we were doing this in our language today, we could use the picture of an eye to mean "ourselves." We might use the picture of a tin can and of a fish to say, "I can fish." This way of writing, however, was hard to work out because there were often things to write for which there were no sound pictures.

Some of these early peoples living on the coasts of the Mediterranean Sea and in southern Asia thought they could find a still quicker way of writing. They had learned that the words they used were made up of parts, or *syllables*. These syllables were used over and over in different words.

HOW ALPHABETS CAME TO BE

They now took the pictures or signs they had learned to make for word sounds and used them to mean just the beginning syllable in that word. Then they made some more signs that were easy to draw. These stood for the other syllables that had no picture signs. Now they could write many sound pictures. That is, they could write words to be read by sound.

Next they used sound signs for just the first sound of each syllable. This was because thinkers had found that many syllables started alike and one sign would do for a sound no matter where that sound was used; so signs came to stand for single sounds. These were the first *alphabets* that man had.

Letter name	Phonetic value	Moab. IX. C., B.C.	Nineveh IX. C., B.C.	Siloam VIII. C., B.C.	Nineveh VII. C., B.C.	Sidon VI. C., B.C.	Samaritan	Jerusalem I. C., B.C.	Modern Hebrew	Modern Arabic
Aleph	'a	𐤀	𐤁	𐤂	𐤃	𐤄	𐤅	𐤆	𐤇	ا
Beth	b	𐤇	𐤈	𐤉	𐤊	𐤋	𐤌	𐤍	𐤎	ب
Gimel	g	𐤌	𐤍	𐤎	𐤏	𐤐	𐤑	𐤒	𐤓	ג
Daleth	d	𐤐	𐤑	𐤒	𐤓	𐤔	𐤕	𐤖	𐤗	ד
He	h	𐤕	𐤖	𐤗	𐤘	𐤙	𐤚	𐤛	𐤜	ה
Vau	v	𐤙	𐤚	𐤛	𐤜	𐤝	𐤞	𐤟	𐤠	ו
Zayin	z	𐤛	𐤜	𐤝	𐤞	𐤟	𐤠	𐤡	𐤢	ז
Cheth	ch	𐤞	𐤟	𐤠	𐤡	𐤢	𐤣	𐤤	𐤥	ח
Teth	t	𐤟	𐤠	𐤡	𐤢	𐤣	𐤤	𐤥	𐤦	ט
Yod	y	𐤠	𐤡	𐤢	𐤣	𐤤	𐤥	𐤦	𐤧	י
Kaph	k	𐤡	𐤣	𐤤	𐤥	𐤦	𐤧	𐤨	𐤩	כ
Lamed	l	𐤣	𐤥	𐤦	𐤧	𐤨	𐤩	𐤪	𐤫	ל
Mem	m	𐤥	𐤧	𐤨	𐤩	𐤪	𐤫	𐤬	𐤭	מ
Nun	n	𐤧	𐤩	𐤪	𐤫	𐤬	𐤭	𐤮	𐤯	נ
Samekh	s	𐤩	𐤪	𐤫	𐤬	𐤭	𐤮	𐤯	𐤰	ס
'Ayin	'a	𐤪	𐤫	𐤬	𐤭	𐤮	𐤯	𐤰	𐤱	ע
Pe	p	𐤫	𐤬	𐤭	𐤮	𐤯	𐤰	𐤱	𐤲	פ
Tsade	ts	𐤬	𐤭	𐤮	𐤯	𐤰	𐤱	𐤲	𐤳	צ
Q'oph	q	𐤭	𐤮	𐤯	𐤰	𐤱	𐤲	𐤳	𐤴	ק
Resh	r	𐤮	𐤯	𐤰	𐤱	𐤲	𐤳	𐤴	𐤵	ר
Shin	sh	𐤯	𐤰	𐤱	𐤲	𐤳	𐤴	𐤵	𐤶	ש
Tau	t	𐤰	𐤱	𐤲	𐤳	𐤴	𐤵	𐤶	𐤷	ת
		I	II	III	IV	V	VI	VII	VIII	IX

From Mason's "History of the Art of Writing"

THE PHOENICIAN ALPHABET

THE FIRST WRITTEN LANGUAGES

The Egyptians during this time had kept on using all of the four kinds of picture writing that had been tried. That makes their writing very hard to read. The Phoenicians borrowed Egypt's writing but used only a part of it. They used only the signs for single sounds, or the alphabet. They improved this alphabet and made it easier to write. The Greeks and Romans got it from the Phoenicians. From the Romans the alphabet came to the English and then to us.

The Chinese were probably the first people to have a written language. They, however, still use signs for whole syllables. They have about fifty thousand different sign pictures, or *characters*, in their language. As in our country some words are used more than others, so it is in China. Most Chinese who go to school learn about four thousand of the different syllable or word pictures that will help them the most.

The Chinese, Japanese, and Koreans can read each other's languages. They do not say their words in the same way in these countries. Even in different parts of their own country the Chinese have different dialects and cannot talk with each other.

This will help you to see how much better it is to have only twenty-six letters to learn and then be able to use them in many different ways.

One reason why the Chinese writing is so much like

the old Egyptian writing instead of like that in most other lands is that the Chinese for hundreds of years did not communicate with any other country.

During this time the Chinese language grew and grew, as more words were needed to tell new thoughts. Today it is so vast a language that they do not know how to change it to make it easier. People from other lands are trying to help them to find a way.

THE BEGINNING OF NUMBERS

Not only did the early peoples have need for written words, but they had need for written numbers. Think

Numbers used nearly 1,000 years ago
in India.

१, २, ३, ४, ५, ६, ७, ८, ९, १०

Numbers used by Arabs 900 years
ago.

١, ٢, ٣, ٤, ٥, ٦, ٧, ٨, ٩, ١٠

Arabic numbers used in Europe 600
years ago.

1, 2, 3, 4, 5, 6, 7, 8, 9, 10

Arabic numbers printed in an English
book in 1480.

1, 2, 3, 4, 5, 6, 7, 8, 9, 10

THE BEGINNING OF OUR NUMBERS

how hard it would be to carry on trade and keep all of the numbers in your head!

Perhaps the Egyptian number system will tell us most about what the others were like. The early Egyptians used lines for single things. For ten things

they used two lines joined at the top. For one hundred things they used a symbol that looked like a watch spring. One thousand was a character that looked somewhat like a flower. Ten thousand was a line with a bend near the top. These symbols or characters were written as many times as they needed them to show their numbers. Could you write your age in Egyptian?

Later on the Romans had signs that were easier to make. These are still used on the faces of many watches and clocks. You may find the Roman way of writing numbers in your arithmetic books.

The figures which we use today came to us also from the countries in southern Asia and Europe. Their story is much like the story of our twenty-six letters. Sometimes when we use figures we might think back over the long years. We can imagine the time when people were trying to find an easier way to keep number records than the Romans had. Our way of writing numbers is called the "Arabic" system. In what ways is it easier than the Roman system? If you try to multiply using Roman numbers you will see.

THE EARLY RECORD KEEPERS

You remember that the first pictures we know about were painted upon the walls of caves. Early man did picture writing also upon stone. The Egyptians used

a mixture of different written forms which are known as *hieroglyphics*. Some of their signs were like letters. Others were more like pictures. They never worked out a real alphabet.



Photo from Ewing Galloway

A PIECE OF LIMESTONE COVERED WITH HIEROGLYPHICS

The Egyptian monuments of stone are carved with hieroglyphics. There is an Egyptian monument, or *obelisk*, in New York City on which the hieroglyphics can be easily seen.

The Egyptians also made pictures and written

records on the stone walls inside the *pyramids*, or tombs of the kings and queens.

Other records made by the Egyptians were made with a reed pen and black and red ink. These records were put upon long rolls of *papyrus*. These rolls were like rolls of strong paper. They were made from the flattened stalks of the papyrus plant. This plant grew on the edges of the Nile River. Today papyrus is raised as a garden plant in some warm countries. Perhaps you may see a papyrus plant sometime.

There was a stick fastened to each end of a *scroll*, as one of these rolls was called. A scroll was kept rolled on the stick where the writing ended. The reader then unrolled the scroll a little at a time as he read. He rolled it up slowly on the stick at the beginning of the scroll.

The Chinese are believed to be the earliest record keepers. They made records with brushes upon flattened pieces of bamboo. They were also the first paper makers. They wrote on paper, we believe, before the time when the Egyptians were using papyrus. It was the Chinese who taught the rest of the world how to make paper.

The Babylonians had another way of keeping written records. They made soft clay bricks. They used a flattened stick shaped something like a screw driver with which to write their symbols in the soft clay.

They then baked these clay *tiles*, or bricks. Some of these writings are known to be about four thousand years old. Often also the Babylonians carved their records in stone. These stone, brick, and tile records



Courtesy Metropolitan Museum of Art

CUNEIFORM WRITING ON A BABYLONIAN CLAY
TABLET

are still found in places where these once powerful people lived.

It took hundreds of years for all this to happen. We shall never know about all the people who tried long and carefully to work out the signs of different kinds with which we write and do arithmetic so easily today. Perhaps it was the Babylonians living along the Tigris and the Euphrates that began this work. Perhaps it

was the Egyptians. We have the oldest records of the Chinese ways of writing. We *do* know that, if these early peoples had not tried to improve on their first ideas of communication, we should not be able to do many things in the ways we are doing them now. Without easy ways of keeping records and using numbers, much of the work of builders and engineers would be impossible, and we should be living the simple lives of the people of long ago.

MORE TO THINK ABOUT AND DO

1. You may be able to have some one find pictures of the early written signs for you in the dictionary or in reference books.

2. Do you know what a rebus is? Perhaps you have worked one out in some magazine. Can you make a rebus for your classmates to read? Which kind of early writing are you using?

3. This story is so full of things to remember that it will be a good plan to read it two or three times. Then be ready to tell in a shorter way the story of how early man helped us learn to write.

4. Make a list of the names of the early peoples who first gave us the alphabet.

UNIT TEN. MAN USES WRITTEN LANGUAGE

I. THE VERY FIRST BOOKS

We have now read about the early peoples that first learned to use written language. We know that they made their records on stone, clay, papyrus, bamboo, paper, and other materials. They also had for a long time used the skins of animals upon which to write. This is called *parchment*. Do we ever use parchment today? For what purposes?

THE FIRST LIBRARIES

There are always some persons in every country who are good thinkers and who can plan ahead of time what needs to be done. People like this, who lived long ago, saw that all kinds of writings should be safely kept. Such men had gathered the early clay blocks or tablets written by the Babylonians into places where they could be read by anyone who needed to use them. Shall we call these the first libraries? How would you like to try to read books of clay?

After the alphabets for each of the early languages, such as the Greek, the Roman, and the Hebrew, had been learned by their writers, there was still much more to do. The new letters must be made into words. These words must be learned by all those who wished to read

what others had written. What would those who wrote need to know?

This all took a great deal of work and study. Only a small number of the people could write or read. However, after the alphabets were invented some of the people of those times began to write books. They wrote stories, poetry, and facts about their religions. There were also records made of important things that happened in the different countries. About what else do you think they may have written?

The early Greeks also had libraries. They were the writers of two of the best known stories of all times. These stories are the *Iliad* and the *Odyssey*. The Greeks knew these stories long before they could write. Story-tellers and singers had told them to their children. As these children grew up they told them again.

This was the only way people had of learning stories, songs, and poetry before they could write them. All the early peoples, so far as we know, had story-tellers and singers. These persons went from tribe to tribe and entertained and taught the people. What were some of the things about which these early teachers probably talked?

SCROLLS AND SCRIBES

Long afterward Alexander the Great became ruler over Egypt. He built a city that was named after him.

This is the city of Alexandria. Here, a little later, were brought together a great many scrolls. It is said that there were five hundred thousand scrolls all in one place



A GREEK SLAVE COPYING A MANUSCRIPT

in Alexandria. This was the greatest library of ancient times.

Every scroll that was made in any of the early countries was done by hand. Every mark was made with a reed pen or some other kind of marker. We may wonder how these early nations could have so many scrolls made. We learn how this was done from reading their own records. In most of these countries there

were people who made a business of copying scrolls to sell to others. The writing was usually done by slaves who were trained to do this work.

Can you imagine a room in those days filled with desks? At each desk a *scribe*, or writer, would be seated with a roll of papyrus or parchment in front of him. His ink and reed pen would also be near by. As a reader said the words slowly, the scribes would write them. In this way, if one man read for one hundred scribes, it would not be long before many copies of the scroll would be ready for use.

Do you know why there are so few of those early writings to be found today? A time came when the ancient countries around the Mediterranean Sea were conquered by more primitive people from the north and the northeast. These people thought only of plunder and of destroying all that was before them. You see now why so many pictures of early records show them as being broken.

These tribes from northern and eastern Europe made such changes in the lives of the southern European peoples that many of their early records were lost.

CHRISTIANITY AND LEARNING

By this time the Christian religion had reached Rome. Many people had become Christians. The tribes from the north did not destroy the churches. The Bible

was first written in Hebrew and in Greek. Later it was also changed into the language of the Romans. This is the Latin language. This language has been used ever since in the services of some churches.

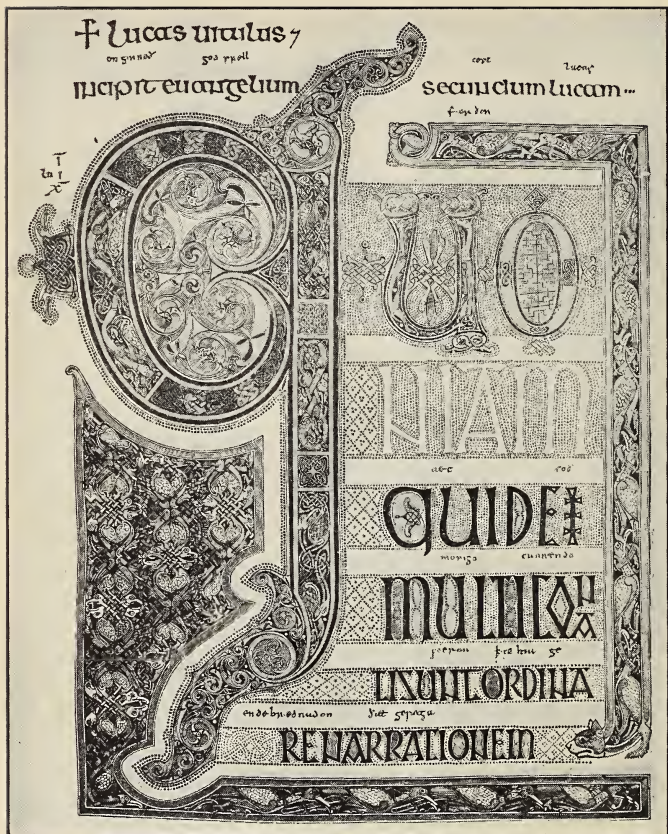
Because they had many writings, the priests taught the people, and they studied to learn more and more about the world and about people's needs. The libraries of the churches kept the Greek, Roman, and other early records for us.

There were other groups of religious men in the early days of the church who spent all their time in trying to live good lives. They also tried to do all they could for others. These men were called *monks*. The places where they lived were called *monasteries*.

Many people who wished to help the church gave land to the monks. These monks did all kinds of hand work, and they always tried to teach the people around each monastery better ways of working and of living.

Among the kinds of helpful work the monks did was teaching school. They taught the people reading, writing, and arithmetic besides teaching them about the church.

You remember that the early scrolls or books were made upon parchment or papyrus. Both of these materials wear out with much use. The Church had been able to make copies of most of the early Greek and Roman writings.



A DECORATED PAGE FROM THE BIBLE

As soon as these writings began to fall apart, the hard-working monks copied them. Many of the copies made by monks nearly one thousand years ago are



From an old print

A MONK MAKING LETTERS LIKE THOSE SHOWN ON PAGE 198

still bright and clear. These monks wrote day after day and made new libraries for their monasteries.

It was about this time that scrolls were changed into books. These were made of pages fastened together at the back just as we have them in books today. The

early monks used *vellum*, a very fine kind of parchment, upon which to write. They were able to write upon both sides of this vellum.

Not only did the monks copy from the scrolls very carefully, but they made many very beautiful letters as they wrote. The monks used colored and gold paint with which to make these letters. Of course, you know that all the letters were printed letters. No one knew how to write any other way for some time after this.

The monks made beautiful leather covers for their books. Sometimes they made covers of carved wood. Most of the books made by the monks were used in the churches. There are no more beautiful books anywhere than those made by the monks. Without their work we should not know much about the early people who did so much for us.

MORE TO THINK ABOUT AND DO

1. Try to make a scroll and to write a short story such as you think a boy or girl living in Rome might have written. You will need to write crossways of the scroll. You can divide your paper with lines if it will make it easier.

2. You will find some of the stories told in the *Iliad* and the *Odyssey* in many of your schoolbooks. Try to read as many of them as you can. In what language were these stories first written?

3. Would it help you to remember the story of communication if you kept a notebook? You can paste

or draw pictures in the book to explain the notes you make. Your book should show only the greatest discoveries and inventions.

4. Make a list of the great nations of long ago that from the beginning helped us to have books.

5. Can you find out what a *hornbook* was?

6. Can you find out what *wax tablets* were and for what they were used?

II. PRINTED RECORDS AND REPORTS

After a few hundred years the Dark Ages in Europe passed. The once primitive people who had destroyed so many writings and other things had now learned to want those same things for themselves. They were no longer primitive. They wished to read and write so that they could communicate more easily.

The beautifully written books made by the monks were very costly. Only a few people could buy them. Some way of getting books for more of the people was needed.

About this time the Chinese way of making paper had been learned by the peoples of some other lands. Some say the Arabs learned it from the Chinese and taught it to the Europeans. It was some years before there was much paper made. This was because at first it was made only from white rags. It was hard to get enough white rags to make white paper. Why do you think this was so?

THE BEGINNINGS OF PRINTING

Another very much needed invention had been made in China long before it was thought of in Europe. This was the Chinese way of printing. The Chinese drew the pictures they wished to print on wooden blocks. They made these pictures backwards. Then they cut part of the wood away and left only the thin edges of wood that made the picture. By putting ink on these raised edges, they could stamp the picture on paper many, many times. The Chinese also used these blocks for printing their word signs.

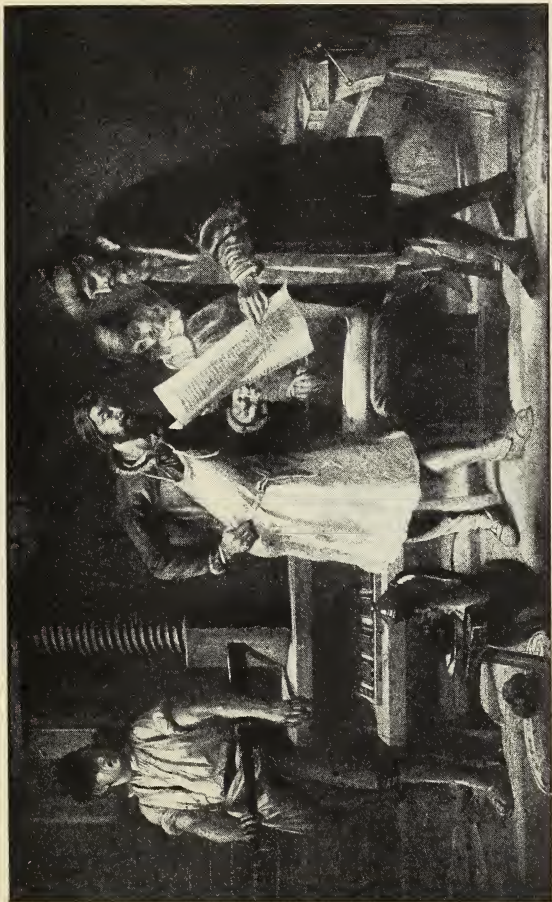
If China had been in touch with other nations in the early days, what differences might it have made in the writing of books in the rest of the world?

The Europeans after a time also learned to cut blocks for printing whole pages of books. Block-printing of books on paper was cheaper than it was to have each book written on parchment.

Even block-printing was, however, a very slow way of making books. A block had to be most carefully cut for each page. Many times the blocks would break. It was still hard to get books enough for the people who wanted to read.

COSTER AND GUTENBERG

Lawrence Coster lived in Holland. He was a block printer. He thought that it took too long to carve



From an old print

GUTENBERG AND HIS PRESS

blocks with so many letters upon them. He also thought that to throw the blocks away after each book was printed was costly and wasteful.

John Gutenberg lived in Germany. At about the same time these two men saw that the letters on the printing blocks could be cut apart and that these letters could then be used again to put into other words. Coster and Gutenberg were among the very first people to make movable letters, or *type*. By putting the letters into new words and fastening them together, the letters could be used until they were worn out. No one seems to know just who was the inventor of movable type. Gutenberg's next invention was making his type from some kind of metal.

Another great need was a better way of doing the printing. A machine that would be easier to use and would print more quickly would make books cheaper. Gutenberg wished also to make more books in less time. He found a way to do this through the *printing press*.

Printing in those days, even with the printing press, was also very slow, hard work. Each letter was taken out of a little box and put into its place to help to make a word. The spaces between the words were filled in with low flat pieces of metal that did not become covered with ink.

As each line of type was *set*, it was placed next to

the line before it to make up the page. After a page of type was set, it was pushed together tightly and fastened so that it was like a block. A block of set type is called a *form*. The form was then fastened to the *bed*, or bottom part, of the printing press. The type was covered with ink with an *inking ball*. This ball was made of wool covered with cloth or leather.

Each piece of paper was dampened and laid carefully upon the inked form. A flat block, or *platen*, was laid on top of the paper. The bed with the paper and platen was now pushed under a *screw press*.

The press was screwed down tight and unscrewed again. The bed was pulled out from under the press. The platen was lifted off and the printed page was laid where the ink could dry. Thus you see it took several minutes to print one page in those days.

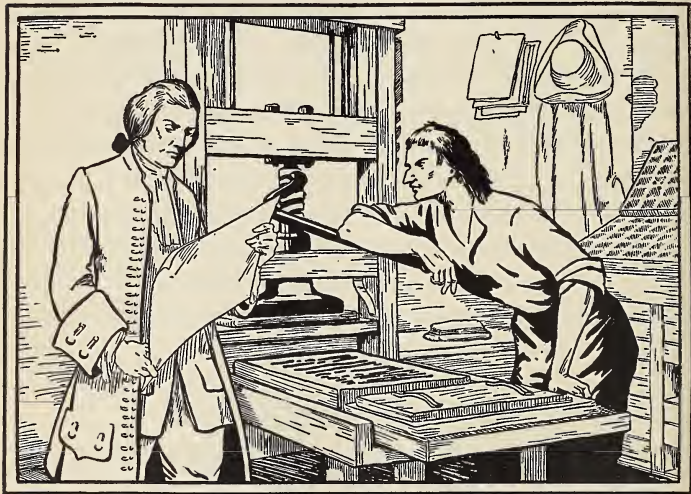
THE EARLY PRINTED BOOKS

This printing was much quicker, however, than was the pen writing of books. Some of the monks are said to have worked all their lives on one book. Sometimes a younger monk finished the work that an older monk had begun.

These first books, made on printing presses run by hand and with type set by hand, were much more easily made than were the earlier Egyptian scrolls. The paper on which books were printed was cheaper than

parchment or papyrus. What else about them showed great improvements? By whom had these improvements been made?

People who had only a little money could now buy a few books. They began to wish to have Bibles of their



A COLONIAL PRINTING SHOP

own. Parts of the Bible were soon printed in German, English, and other languages. The Bible is said to be the first whole book that was printed from movable type.

As people learned to read their Bibles, they wished to read other books also. Printers could not print books enough to satisfy those who wished to buy them.

The first books to be printed were very carefully made. They were almost as beautiful as those written by the monks. The printers tried very hard to make their printing look like hand printing. The beginning letters and the pictures were often colored by hand. By the time Columbus had discovered America, printing had taken the place of pen writing in the making of books.

MORE TO THINK ABOUT AND DO

1. Try to find out all that you can about paper making in the long ago. Who were the paper makers even before the Chinese?
2. Try to make a list of all the ways in which we use paper today.
3. Write five sentences that tell the most important things in this story.
4. Cut a block of soft wood or soap from which you can print your initials.
5. Take the letters of your name and see how many different words you can make with them.

III. PRINTING MULTIPLIES COMMUNICATION

The printing press was invented about the year 1450. At once men began to think about and to try ways of improving it. For some time not many improvements were made.

After a while different inventors found easier ways

of using the platen. Some one else began making all parts of the printing press out of iron.

Another inventor learned how to make a thicker kind of ink that would stay on the type and make clearer letters. Next, a roller covered with ink took the place of the inking ball.

Some one had found out how to make the bed slide back and forth on a track as the platen was raised and lowered. This was done by turning a crank instead of pushing the bed back and forth by hand. Why was this easier and better?

THE PRINTING PRESS AND THE FIRST NEWSPAPERS

Some one learned how to run the machinery of a small press with one foot. This was done about in the same way that some sewing machines are run. These small printing presses are still found today in many places. They are often used for small pieces of printing called *job printing*.

The invention of the *cylinder press* brought another change in ways of printing. The cylinder was a large roller. It was so placed that it turned round and round over the bed of the press. As it turned, the roller caught a sheet of paper. It rolled it against the inked type. Then the cylinder carried the printed sheet along until it could be taken off by the pressman. He placed it where it could dry.

The *London Times* of Nov. 29, 1814, is said to have been printed on a cylinder press run by steam. This tells us that newspapers had now been added to man's ways of communicating. The press used for the *London Times* in 1814 could print one thousand copies in an hour.

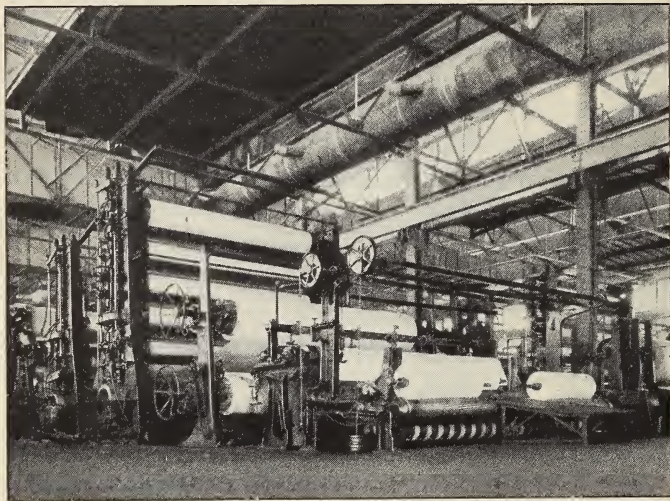
During the time that printing presses were changing, the kinds of letters that made up the words were also changing. The pen letters of the early books had been made with both heavy and light lines in each letter. It was sometimes rather hard to tell one letter from another when they were seen alone. Why did the printers not like this?

At first each printer made his own type. For a time a good many different kinds of letters were used. After a while each printer had some of each of the kinds of letters that he liked to use. Printers liked the letters that printed well. People also liked the letters that were easy to read. Besides having different kinds of letters, printers needed to have them in different sizes.

Not only are both capital and small letter alphabets printed in different sizes, but they are also made with heavy or light lines. Some of the different kinds of type are known by such names as "Old English," "Bold-face," and "Script." Most of the printing in the English language is done with Roman type.

BETTER PAPER HELPS PRINTING

Along with the early improvements in the printing press there had also come changes in the making of



Courtesy Champion Coated Paper Co., Hamilton, Ohio

THIS MACHINE MAKES FINISHED ROLLS OF PAPER OUT OF RAW PULP.

paper. Some people think that the making of paper has helped communication as much as printing.

As long ago as when the Romans were a strong nation, men had known how to make paper from plants and rags. Because the making of paper was such slow, hard work, not much paper could be made.

In 1770 there was invented a machine that did much

of the hard work of paper making. It was called the "Hollander machine." Soon many people learned that wood could be made into paper by machine power. Paper making was then carried on in all of the countries that wished to have books and newspapers.

The improvements in the machines for making paper and in the paper that is made have gone on ever since. New inventions are changing paper making even today. Paper uses up wood faster than trees can grow. Men are trying to make paper now from other materials besides wood. Some of these things we now throw away. What do you think some of these materials might be?

NEWSPAPERS FOR EVERYBODY

While men were making better printing presses and better type and were having better and cheaper paper to use, books and newspapers were being read by more and more of the people.

Benjamin Franklin worked in London at printing in 1725. He was one of the early printers in our country. Other Americans were trying to improve ways of printing and they made some of the inventions that helped printing to be easier and quicker. One of the early improvements in printing presses was made by Samuel Rust of New York City in 1827. He called his press the "Washington press." Why did he give it this name?

The one improvement that perhaps was needed most of all was not made for many years. Can you think what this was? All printers hoped that some day it would come. For a long time it seemed beyond man's power to build a machine that would set the type and then after it was used, put it back into the little boxes where it belonged. At last man found a way as he had done so many times before.

THE LINOTYPE AND MODERN PRINTING

A machine was finally built by a man named Ottmar Mergenthaler, of Baltimore. It is called the *Linotype Composing Machine*. This machine has inside of it many little patterns, or *dies*, for making type. By touching keys, such as are on a typewriter, these little dies will fall into words in a line. As fast as a line of dies is made, the line is carried along inside the machine. Each die is filled with melted type metal. This makes a whole line of type all in one piece. As soon as the metal is cool, it can be used for printing books or newspapers.

The linotype machine can also put the little dies back in place to be used again. After the type is used, it is melted and used over and over. Today in all parts of the world typesetting machines are used. They are of several kinds. Each is in some ways like the first machine. These machines have different names and

do the work in different ways. What have these machines done for communication?

Men through the years have learned to set type with machines. They have also learned to print with great



Photo from Ewing Galloway

THE LINOTYPE OPERATOR HAS A KEYBOARD SOMEWHAT LIKE THAT OF A TYPEWRITER.

power-driven presses that print both sides of the paper at once. These great machines now print a whole newspaper at a time and fold it up ready for the newsboy.

Not only have men learned to print more than one hundred thousand newspapers in an hour, but they

have invented presses to print beautiful colored pictures. These machines are called *lithographic presses*. The colored pictures are called *lithographs*.

The story of the printing of colored pictures on machines is too long to tell here. It has taken many, many hours of hard study to find a way to make books beautiful as well as useful. Today ways are being discovered to make colored pictures even more beautiful. Better still, they can now be made cheaply enough so that everyone may have them. How did the long-ago people get pictures?

Books, catalogs, newspapers, magazines, printed letters, and posters are only some of the ways of communicating with others that the printing press and the making of paper out of wood have brought to us. What are some of the other things that these inventions working together have given us?

MORE TO THINK ABOUT AND DO

1. Try to find out all you can about paper making today.

2. Write ten sentences leaving out one word in each that tells something about printing. Ask your classmate to change papers with you. Try to fill in the words in the paper you get.

3. Try to visit a printing office and learn all you can about the different kinds of printing presses in use.

4. Look at the different kinds of paper in an

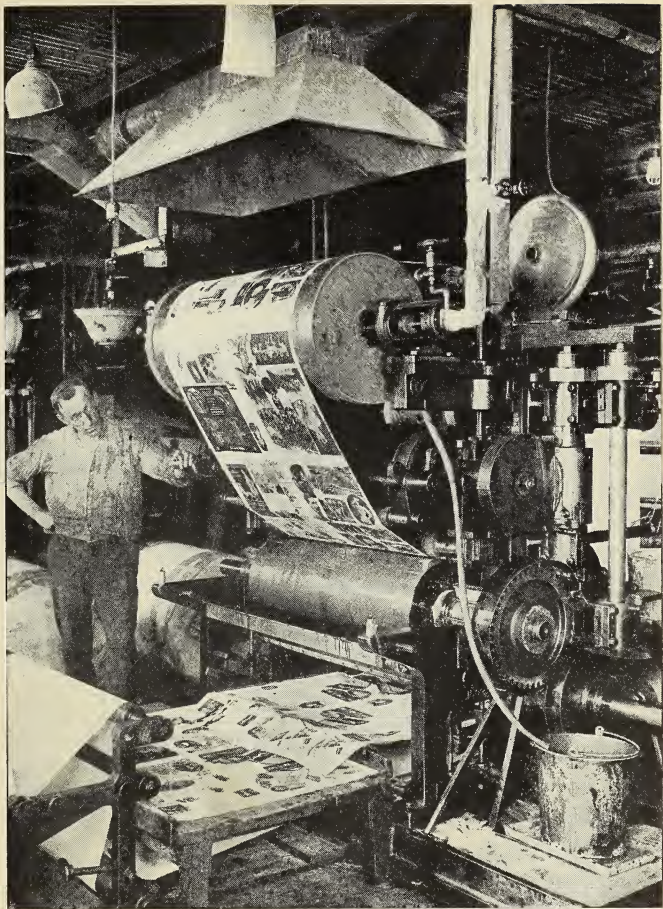


Photo from Ewing Galloway

A PRESS FOR PRINTING FINE PICTURES LIKE THOSE IN A SUNDAY
NEWSPAPER SUPPLEMENT

office. Find out of what each kind of paper used in that office is made.

5. Try to visit a newspaper office. Ask some one to show you how the reporter's story finally gets into the newspaper.

6. Ask at the newspaper or printing office to see the "plates" from which pictures are printed.

7. Make a list of all of the things that you use in your home or at school that have printing upon them. How does this printing help you to communicate?

8. If you were visiting a country which used a language you did not understand, would printing help you? Why or why not?

9. What are three kinds of communication that you find in every newspaper?

10. Can you read these numbers?

Our country has about 700 magazines for farmers. There are almost 300 magazines for children in the United States.

There are at least 2,500 different daily newspapers published in our country.

About 15,000 different new books are printed each year in our country.

About 1,100,000 tons of paper are used each year for books alone.

Over 1,500,000 tons of paper are used each year for newspapers.

There are about 40,000,000 newspapers printed each day in our country.

UNIT ELEVEN. WRITTEN AND PRINTED COMMUNICATION GOES AROUND THE WORLD

I. THE CARRYING AND DELIVERY OF MAIL

We have read about the early ways of sending messages. We know that these messages were very helpful to the people who lived at that time. Such ways would, however, not seem quick enough for us today. In the days of long ago, as soon as people had learned how to write, they began writing letters to each other. Most of these very early letters were about the government.

The early rulers in some countries had learned that men on horses were swifter and safer than men on foot. These rulers had riders with horses all saddled and waiting at places that were a day's journey apart. The waiting rider took the written messages quickly as they were brought to him. He then rode away on his horse as fast as he could go.

By using riders on strong, swift horses, rulers sometimes sent letters as far as a twenty-five days' journey. This was often all the way across the lands ruled by one of these men. These carriers were called *posts*. Can you tell why?

THE WORK OF THE POSTS

After a while the rulers allowed the posts to carry letters for a few other people. This was done only for those people whom the ruler wished to please. There was no way for most of the people to send letters anywhere. Some rich people who had slaves sent letters to others by their own slave runners or riders.

For a few years there were posts who were not sent by the government. These were riders who were paid by business men to carry their letters from one country to another. Some governments did not like these posts which the business men had and they were soon stopped. By the year 1700 most of the countries of Europe had government posts carrying mail for anyone who could pay the postage.

No envelopes were used in those days. Letters were folded and sealed with wax. The postmaster wrote the cost of sending the letter on the outside. A letter could be sent "paid" or "collect." What do we send that way today?

THE POSTS IN OUR COUNTRY

In our country the first *post office* was in the Colony of Massachusetts in 1639. Posts on horseback went once a week in summer from one eastern colony to another. They went about once in two weeks in the winter.

After our country became the United States, the postal service was improved. Regular trips were made between all the cities in the eastern part of the



Photo from Sanborn Studio

AN OLD-TIME POST RIDER

From a painting by Stanley M. Arthurs

country. The people were given more post offices so that they could leave their letters for the riders and stage-coaches to take. They could also get letters more easily.

It cost from eight to twenty-five cents to send a letter. The letters that were sent to people farthest away cost the most. England had begun to print postage stamps. People liked that way of paying for postal service. Our country printed stamps in 1847. The five-cent stamps had Franklin's head on them. The ten-cent stamps bore the head of George Washington.

THE PONY EXPRESS

In the western half of our country the early mail service was quite different. Gold was found in California in 1848. In one year after this there were people coming across the hot desert and over the mountains to that part of the country to find gold. Not everyone found even enough gold to pay for the long journey.

Many of the people who came West liked California and wished to stay there. Other people kept on coming, and California became a part of the United States in 1850.

You remember that there was no railroad to California at this time. The only mail service was by overland stagecoach from St. Joseph, Missouri, to San Francisco. This trip took several weeks. The *Pony Express* was planned about ten years later to give fast mail service between San Francisco and St. Joseph on the Missouri River. This service was done not by the government but by business men.

Once each week a pony expressman started from San Francisco to go east. At the same time a pony and rider left St. Joseph to go west. The trip was to be



Courtesy First National Bank of St. Joseph, Mo.

“THE PONY EXPRESS RIDER” — A WALL PAINTING

made in about two hundred forty hours. How many days was that?

The stations were twenty-five miles from each other. Each rider went seventy-five miles in a day by changing horses. The riders were allowed two minutes to change horses at the end of each twenty-five-mile run. It cost two dollars and fifty cents to send one-half an ounce of mail on the Pony Express. William Frederick Cody, who is better known as Buffalo Bill, was a pony expressman.

Perhaps the fastest run was made when the Pony Express carried copies of a speech that Abraham Lincoln gave when he was made President of the United States. The people of San Francisco wanted very much to know what Lincoln said in that speech. They were reading it in about eleven or twelve days after Lincoln gave it in Washington. How long do we wait now to know what our President says in his speeches?

THE GOVERNMENT ADDS MORE POSTAL SERVICE

While Abraham Lincoln was President, he allowed cities in our country that had 50,000 people in them to have mail carriers. These carriers brought the mail to the people's houses. The first mail boxes on street corners came at that time. In 1873 postal cards were first used in our country. The *postal rate* in the United States was then about what it is now for sealed letters that did not weigh more than one ounce.

Horseback riders were by this time used only where there were no railroads, steamboats, or stagecoaches to carry mail.

All railroads were *post roads*. As soon as the railway systems were formed, the mails moved quickly wherever there were railroad lines. Where were some of the places where the older ways of carrying mail would still need to be used?

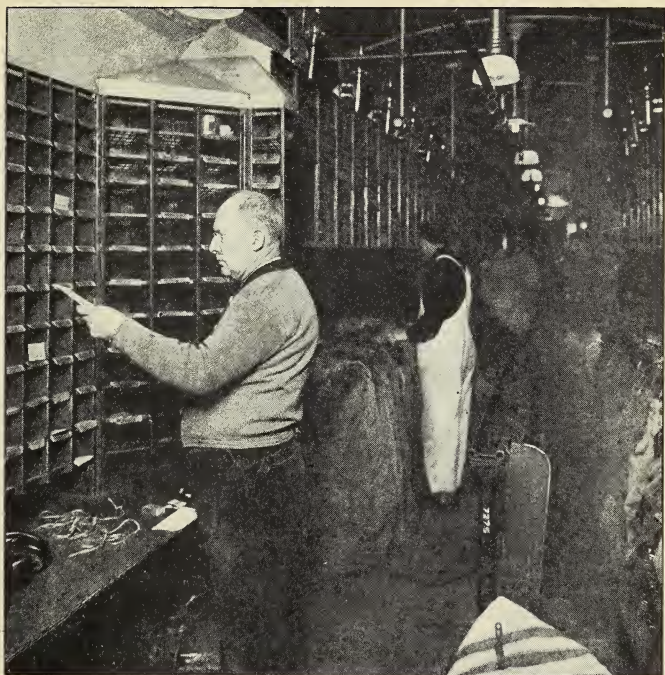


Photo from Brown Bros.

SORTING MAIL ON A MAIL TRAIN

POSTAL SERVICE IN OTHER COUNTRIES

In other countries ways of traveling and of sending goods had been improving all the time. About the same changes in mail service were being made in other lands as were going on in our country.

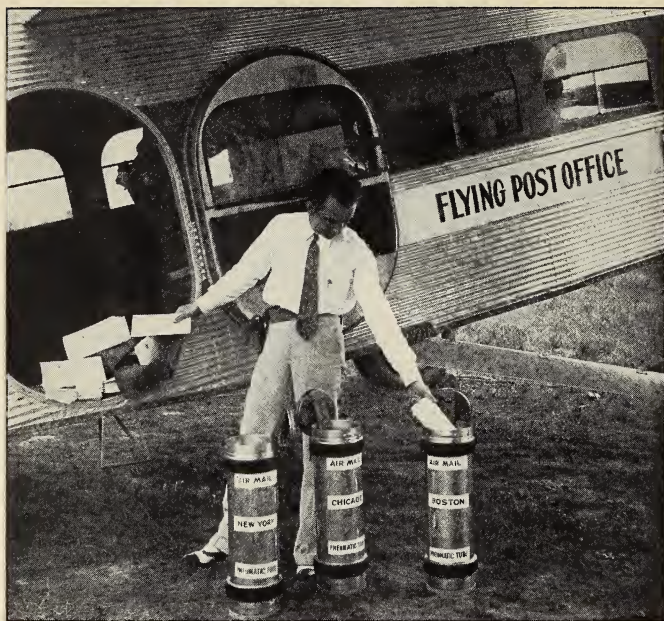


Photo from R. I. Nesmith and Associates

AIR-DRIVEN TUBES SHOOT THE MAIL FROM THE AIRPORT TO THE CENTRAL POST OFFICE.

In 1874 the *International Postal Union* was formed. This is a system for sending mail between the countries that belong to this union. Nearly all the nations in the world belong to the International Postal Union now.

A letter to go from one country to another must be marked with the name of the post office where it was

mailed. It must have as much postage on it as the country to which it is going asks to have on letters of its kind.



Photo from Ewing Galloway

A BUSY CORNER IN THE PARCEL POST DEPARTMENT

Today we think no more of sending or of getting letters from other countries than people used to think about getting them from a few miles away. It does not cost so much now to send a letter across an ocean

to another country as it used to cost to send a letter from Boston to New York.

Carrying letters or postal cards is only part of the work that the postal service of different countries does for their people. Newspapers, magazines, and many other kinds of printed matter go in and out of all post offices every day. Postage rates are different for different kinds of printed or written mail. The rates are highest for sealed written messages. Why is this?

PARCEL POST

In 1912 our government began to let post offices send packages that do not weigh more than fifty pounds. These packages must be very carefully wrapped, tied, and addressed. There must be nothing inside the package that will break. Nothing can be sent that will hurt any other packages or other mail.

Each large package is measured. The length and width are added together. The sum must not be greater than eighty-four inches. The cost for sending is so much for each pound or part of a pound. It also costs more if the package goes far away than if it goes to a near-by place.

SENDING GOODS BY EXPRESS

You can probably think of many things that people wish to send quickly that cannot go by parcel post.

Packages of all kinds are also sent by *express* just as quickly as if they went by parcel post. The express car is usually on the same railroad train as the mail car.

The Railway Express Agency is not a government service. It is a great business system that is now owned by all of the railroads together. The express company does other things for people besides carrying packages. One of the things the express agency does is to send money for people. The Railway Express Agency has some *air express* routes.

You will usually find the express office near the railroad station. The way packages are sent by express is much like parcel post. The cost is about the same. What differences can you see between these two ways of sending goods quickly?

POSTAL INSURANCE

You know what it means to have a house or an automobile *insured*. It is done by paying an insurance company a small sum of money for what we call *protection*. A house may be insured against fire. If it should burn down, the fire insurance company will pay the owner for the house. The company can do this because only a few houses burn. Nearly everyone pays for protection on his home so that the company has money to pay to the few people whose houses burn.

The part of our government that takes care of all

of the postal service is called the *Post Office Department*. The Post Office Department gives different kinds of mailing protection to all of those who wish to pay for it.

If you send a package by parcel post, you can pay a few cents more and have the package insured. This means that, if anything happens to the package while it is in the mail, the post office from which you sent the package will pay you for your loss. For a small sum you can also have *special handling* of your parcel-post package. That means that the package will be carried as quickly as a letter. What kinds of packages should have special handling?

REGISTERED MAIL

By paying about fifteen cents extra, a letter or package may be *registered*. This means that the mail will be put in a registered mail sack with other valuable letters or packages. Perhaps there are large sums of money in this mail. No money should ever be sent in letters unless the letters are registered.

The sender gets a piece of paper from the postal clerk telling him that his government will see that this letter or package goes to the person to whom it is addressed. No one else can even get the mail if the sender wishes it that way. Letters may be sent by registered mail to other countries.

If the person sending registered mail asks for it, the one who gets the letter or package must sign a *return card*, saying that he has the mail. Registered mail is carefully guarded all the time that it is in the hands of the government.

POST-OFFICE MONEY ORDERS

It is sometimes better to send small sums of money by a *money order* than by registered mail. The sender by paying a few cents can have this service from almost every post office. The money to be sent is paid to a post office. A piece of paper, stamped and telling how much the order is worth, is given to the sender. This is put into a letter. Only the one whose name is on the order can get the money. This is paid by any money-order post office if the person with the order is known to the people in the office. Of what help is this service to people? How is it a kind of protection?

POSTAL SAVINGS BANKS

To help people to save money, the Post Office Department will take small sums of money and keep them safely for anyone who wishes to have them do so. The government pays each person two cents for each dollar that is left in the Savings Department for one year.

SPECIAL DELIVERY AND C. O. D.

After a letter or package is stamped for sending, another stamp may be put on. This is a *special delivery* stamp. Any mail bearing this stamp is



Photo from Ewing Galloway

DEPOSITING MONEY AT A POSTAL SAVINGS BANK

delivered as soon as it comes to the post office to which it is addressed. Find out how much this service costs.

Some people write letters to business houses and ask to have goods sent to them by mail. Instead of sending the money, they may ask to have the goods sent

to them C.O.D. This means "cash on delivery." They must pay the mailman before they may take the goods.

OTHER KINDS OF POSTAL SERVICE

Rural free delivery began in the United States in 1897. Now in most parts of our country both in



Photo from Brown Bros.

A REVOLVING TABLE LOADED WITH RURAL DELIVERY MAIL BOXES

winter and summer all people may get their mail every day. The faithful, rural mail carriers go on their long routes if they can get through the roads. Some go in cars, some drive horses, and some go in other ways.

Can you think of the ways other rural mail carriers might travel?

The Post Office Department has also given us air-mail service. By paying a little more than the regular postage, a letter will go by air mail as far on its route as it can. Have you ever seen an air-mail plane going through storm and fog? Why must the pilot do this?

One of the most helpful parts of the whole postal system is the railway post office. This is a traveling post office in a mail car. As soon as mail is put on the car, the mail is sorted and is put into the right sacks to be sent on other trains at each railroad center. This saves hours of time in sending mail. In most countries of the world the postal service is much like that in our country. Governments for a very small sum do what people want to have done for them. What other kinds of service does our government do for us?

MORE TO THINK ABOUT AND DO

1. Find out from your parents or from other grown-up people all that you can about the ways mail was carried when they were children.

2. Write a letter such as you think one child might have written to his or her cousin in a different colony in our country at about 1700. Seal your letter as it was done in those days. Where would you have gone to mail the letter?

3. Would you like to start a collection of the postage stamps that have been used in our country since the first stamps were printed? You will find these interesting to you later on in your school work.

4. Would you like to try to get stamps also from other countries? Many children and grown people have very large collections of postage stamps. What can we learn from postage stamps?

5. Visit the post office nearest to your home. Ask the postman or some one else to show you about the work done in the post office.

6. Find out about the Dead Letter Office.

7. Make a list of ten questions that you can answer and ask others to answer about postal service.

8. Make a list of words from this story that you would like to remember.

II. ELECTRICITY CARRIES MESSAGES

THE TELEGRAPH

Sending messages by signals was one of man's earliest ways of telling "the news." Later he learned to write letters and he sent them by the post. The post became the government postal service. Man, however, was always trying to find quicker and better ways of sending messages.

Many men working in different parts of the world told each other what they had learned about electricity. This is the reason that people learned to use it as soon as they did.

THE ELECTROMAGNET

About 1820, in Denmark, an invention was made that helped to give us the telegraph. Inventors had learned that they could wrap wire around a piece of iron and send an electric current through the wire. While the current was in the wire, the iron would pull another piece of iron to itself with a sharp "click."

If the wire carrying the electric current to the iron was cut apart, down dropped the piece of iron that had been picked up. If the ends of the cut wire were held together, the *electromagnet* picked up the piece of iron again that it had dropped. The inventors had now learned how to make and to unmake an electromagnet whenever they wished to do either.

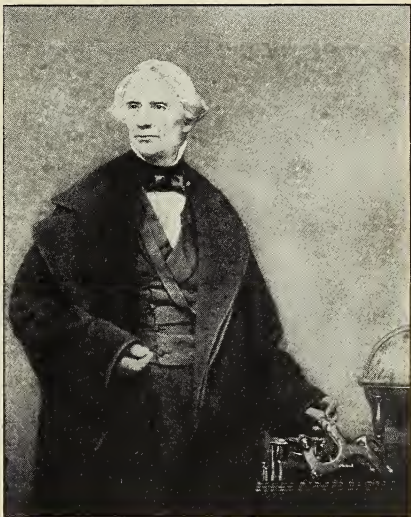
SAMUEL F. B. MORSE

Samuel F. B. Morse, an American artist, was on his way home from England in the packet ship *Sully*. On the trip he heard about the invention of the electromagnet. That night Morse thought more and more about using this invention to send messages over very long wires. He saw that one person could be near the electric battery that furnished the current to make the magnet. Another person could be far away near the electromagnet at the other end of the wire. By making and breaking the electric connection at the battery end of the wire, the person at the other end

could see the piece of iron move and could hear the clicks as the magnet pulled it.

Morse did not think about the clicks. He thought only about making a piece of iron move back and forth. He planned to fasten a pencil to the iron so that it would make marks as it moved.

When Morse reached his home in New York City, he worked as much as he could on his electric machine to send messages. He was in great need of money. This kept him from buying what he needed to carry on his electrical work. After about three years he could send a message in his workshop.

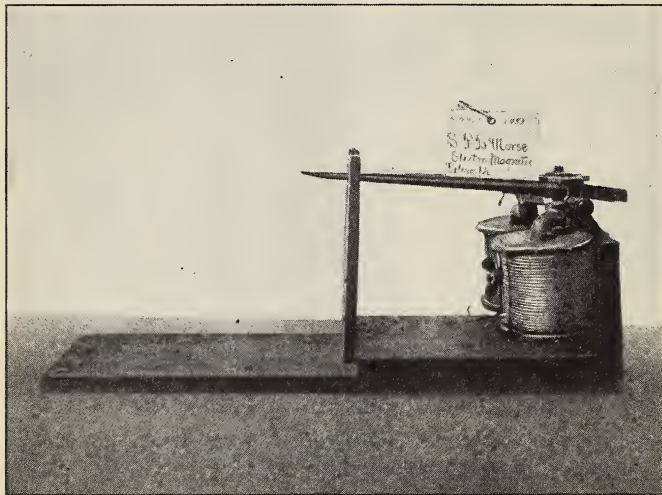


SAMUEL F. B. MORSE

MORSE GETS HELP

One day Alfred Vail came to see Morse. Vail wished to work with Morse. Vail's father gave the two men

some money to buy materials. Alfred Vail began to work upon the first machine that Morse had built. He made improvements upon it.



MODEL OF MORSE'S FIRST TELEGRAPH INSTRUMENT

In 1838 Morse and Vail sent a message to each other by telegraph. Vail had found a better way to spell out words than Morse had planned. The letters of the alphabet are made with long and short pulls by the magnet. These are the *dots and dashes* of the *Morse Code*, or alphabet. The taking of telegraph messages was soon done by sound instead of by marks. The

clicks made by the iron hitting the electromagnet tell which clicks stand for dots and which stand for dashes. The one taking the message hears these and he writes the letters that he hears on the *sounder*.

TELEGRAPH LINES ARE BUILT

Another inventor in England was also working on a telegraph about the time that Morse and Vail were working in our country. Both countries began using the telegraph at about the same time. The first telegraph line in the United States was built from Baltimore to Washington in 1844. This line was about forty miles long.

Morse kept at work on his telegraph. He soon found a way to send messages as far as wires could be put up. This was the beginning of the great telegraph systems of the world today. How does the telegraph help the newspapers?

THE TELEGRAPH AND RAILROAD SYSTEMS

If it were not for the telegraph, or something like it, we could not have railroad systems. It is by means of the telegraph at the railroad centers that the different railroad lines can work together. In this way better communication has made better and safer transportation.

Each railroad line also uses the telegraph all day

and all night if there are any trains running on the road. A message goes from station to station ahead of each train.

SENDING TELEGRAMS

Business men use the telegraph for many kinds of messages. A *night message* or a *night letter* will be delivered the first thing the next morning. These are cheaper than *day messages* or *day letters*. A day message or a night message may each have ten words in it. After the first ten words each added word costs a few cents more. Messenger boys deliver day messages or day letters as soon as they are clicked by the sounder and changed into words at the telegraph office. In cities the telegraph company also sends messenger boys to get messages to be sent away. People can send money by telegraph if they wish. It is like sending a post-office money order only that the money can be had as soon as the message is delivered.

NEW IMPROVEMENTS IN THE TELEGRAPH

As the telegraph was used more and more, improvements were needed and were made by later inventors. In the large telegraph offices today, the messages are sent by pressing the keys of a kind of typewriter. The typewriter makes little holes in paper like dots and dashes. This paper is then put on a sending machine and the electric current is made and broken by another

machine. This machine works through the holes in the paper.

At the other end of the line the message sent may be taken by sound. It may be taken by a dot and dash machine. It may also be taken by a printing machine. This machine is connected with the telegraph and makes the letters that the electric current spells over the wire.

There are other wonderful improvements being made in the ways of taking and sending of telegraph messages. New kinds of machines, run by electric power from dynamos, can do more and better work in less time than man could do by hand.

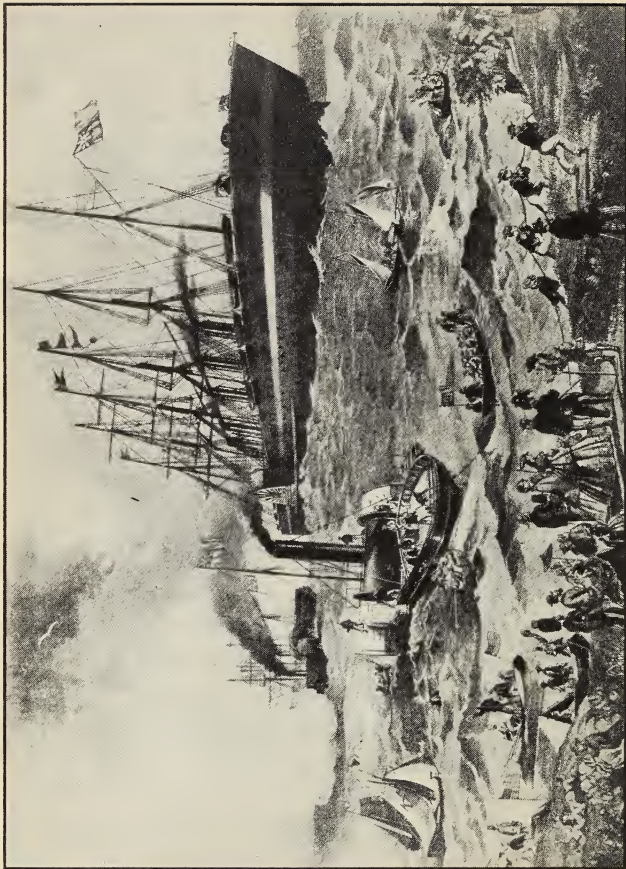
THE TELEGRAPH GOES UNDER OCEANS

The service of the telegraph helped communication so much on land that people wished to talk to each other across the water.

A *cable* is a telegraph line that goes along the ground under water. Both Samuel Morse and some men in England began making wires that could be put under water and then made to carry electric current. A few short cables had been tried. These worked very well.

THE FIRST ATLANTIC CABLE

Cyrus W. Field, of New York City, thought that a long cable could be laid from the United States to



Courtesy The Western Union Telegraph Co.

THE GREAT EASTERN LAYING THE ATLANTIC CABLE

Europe. The English government and our government liked the plan. Companies of people furnished the money to make and to lay this long cable. The governments helped with this work by furnishing ships.

The laying of a cable across the Atlantic Ocean was very hard to do. The cable would break. Other things happened that stopped the work more than once.

The first cable worked only one month. A new cable was made. The *Great Eastern*, a large ship for that day, carried this cable and finally laid it all the way across the ocean.

Since 1866 Europe and America have been sending messages to each other by cable. Many other countries are connected across water by cables. Newspapers get news from other countries almost as soon by cable as they get telegraph news from their own lands.

WRITTEN MESSAGES WITHOUT WIRES

Men had known for a long time that an electric current would go from a battery or dynamo on a wire. They knew there must be another way for the current to come back to the battery or dynamo. This made an *electric circuit*. They had learned that the ground would act like a wire to bring the current back. They had seen the telegraph work by making and breaking an electric circuit.

Marconi, a young Italian, had been thinking about these things. He knew of some new discoveries about the way light travels. He had found out more about the way electricity moves. He used his discovery with the Morse telegraph. Marconi did not have a wire go all the way from his electric battery to the sounder of the telegraph. He did something else. He used two short pieces of wire. He turned one piece of wire straight up in the air at the battery end of his telegraph. He turned the other piece of wire up in the air at the sounder. Then he tried to send a message. The sounder "clicked." The electric power had gone out on the short wire at one end. It had come down the wire at the other end. The *wireless telegraph*, or wireless, had been invented.

SENDING WIRELESS MESSAGES

Marconi and others kept at work to find ways of making the wireless work over longer and longer spaces. Wireless messages can be sent farther than around the world now. These messages cost more to send than cablegrams. Newspapers use wireless to gather news from places where there are no cables.

Marconi's invention has been of the greatest help to ships at sea. One end of a wireless circuit may be on land. The other end may be on a ship. A circuit may also be made between two ships. Now people

on ships can send messages to people on land. They can send messages to people on other ships. The captain of a ship can now get the *weather report* every

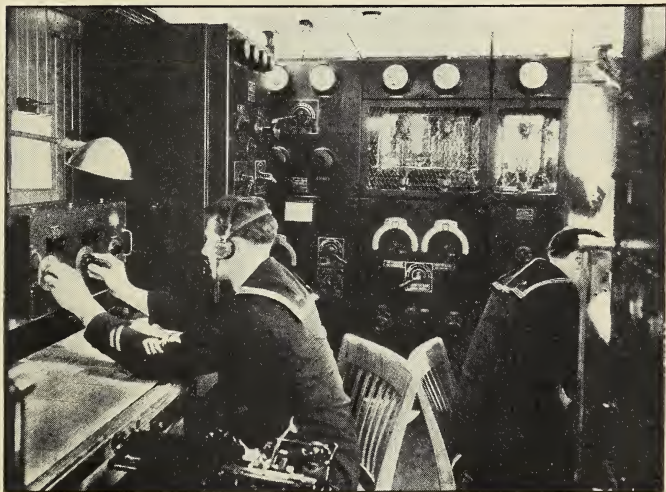


Photo from Ewing Galloway

A RADIO ROOM IN A COAST GUARD CUTTER

few hours from the nearest wireless station. How does this make travel safer?

On passenger ships a little newspaper is printed every day so that the travelers may know what is happening all over the world. The news for the little paper comes by *radiogram*, or wireless telegraph.

“S.O.S.” is the message that means that the ship

needs help. It is not often now that a ship in distress is not given help by other ships. No one knows how many lives have been saved by Marconi's invention.

MORE TO THINK ABOUT AND DO

1. You will find stories in your readers and in other library books about the inventions in this story. Choose one to read and tell to others.

2. Are you writing the things you wish to remember in your notebook on communication?

3. Can you write your name with the Morse alphabet or code? Try to tap it on your desk.

4. Visit a telegraph office if you can. You will learn much more about sending messages.

5. Write a night letter of fifty words telling about some invention in this story. See how much you can say in a few words.

6. Change that night letter to a short day message.

7. If you have a newspaper, see if it tells how the different news stories came to the paper. Find as many different ways as you can.

8. Make a list of the new words you will need to use in talking about the changes these inventions made in communication.

UNIT TWELVE. HEARING AND SEEING AROUND THE WORLD

I. SPEECH AND ACTION RECORDS

While the telegraph was becoming one of man's great helpers, another inventor was hard at work. He was thinking about another way of keeping records. Books are records of man's thoughts. Other people read these records. People write music. Other people play or sing the music. Written music is also a kind of record. Can you think of other kinds of written records?

The records that Thomas Alva Edison hoped to make were not to be written records. They were to be sound records. He learned some of the things he needed to know while he was helping some other inventors to make their inventions more useful.

HOW SOUND IS MADE

You have seen the waves or ripples made in water when something falls into it or moves about in it. People had learned that air moves in waves much as water does. There are different kinds of waves made by different things. There are also different kinds of waves made in the air. Edison knew that we can hear because waves of air strike the *drums* of our ears. He knew that because there are different kinds of air

waves we have learned to know them as different kinds of sounds. Edison also knew that talking is really making air waves.

One day he was working at another invention when something happened that gave him an idea. He would make a machine that would give back, again and again, sounds that were kept on records.

THE PHONOGRAPH IS INVENTED

Edison's first work then was to catch sound waves and put them on a record. This he did with a machine that he planned. A pin was fastened to the middle of one side of a thin piece of metal. The metal was held so that it would be hit on the other side by air waves when some one talked into the machine. Edison knew the waves would make the metal move quickly back and forth. It would do what a tight string does when we snap it. We call this *vibrating*. Air waves then would make the metal vibrate.

Just below the pin, Edison had a piece of tinfoil fixed so that it would move along when he turned a crank. Edison lowered the pin so that it could make a path in the tinfoil. He began to talk into the machine. The pin made a bumpy path in the tinfoil as it moved along. This path was made just the way the vibrations of the metal pushed the needle. When the record was finished it looked like a long thin line of "ups and downs."

Now Edison set the "record" made by the pin under it again. This time the pin was made to follow the path it had made before. The pin then pushed the piece of metal back and forth as it went along. The

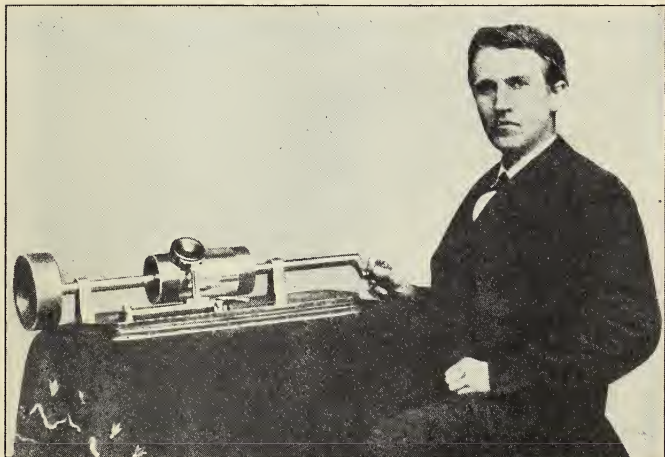


Photo from Brown Bros.

EDISON AND HIS FIRST PHONOGRAPH

metal made waves in the air. Edison who had talked now heard in a clear voice the words that he had said. The phonograph was almost ready for man's use. Soon man could talk into a record-making machine. Years afterward he or his children could hear him say the same thing again.

IMPROVEMENTS IN THE PHONOGRAPH

Soon larger and better machines were built for making records. Wax records were tried. Then better and better ways were found to make phonograph records that would play over and over without wearing out. How would a record wear out?

Then Edison and others working with him began to improve the rooms in which the records were made. These rooms were built so that the sound waves would do their best work in making air vibrations. We shall see later how this work helped other later inventors. Today there are also greatly improved ways of making the sound paths in the record. This has come because people have learned more about electricity.

While this was going on, many changes were being made in the phonograph as we know it. We do not now use a crank to turn the record under the needle. We may wind the phonograph as we wind a clock. Then the record turns under the needle and we hear the sounds. Many phonographs are now run by an electric current. These phonographs do not have to be wound.

The phonograph has also been made beautiful as well as useful. There are large phonographs and small ones. The early phonographs had big horns on them to make the sound waves strong enough to be heard. Now the sound waves are made strong inside of the phonograph itself. In the newest phonographs this is done by means of another discovery about electricity.

WHAT THE PHONOGRAPH DOES FOR US

Before there were phonographs, only a few people could hear the best music that was played or sung. Operas, concerts, and choirs could often be heard by those who lived in cities. People who lived in smaller places did not hear much of the best music unless they went to the cities.

Now beautiful music is put upon sound records. These records can be bought in music stores in almost every country of the world. They can be heard over and over. The things people wish to say can be put on records also. Whole speeches can be recorded in this way. Instead of having to read people's thoughts, we can hear them say what they think.

The phonograph is used to teach people things they wish to learn. It is used in hospitals to cheer people who are sick. Let us think what the phonograph has done for blind people who cannot read printed books. You will think of many other ways in which the phonograph has been useful to people everywhere.

THE IDEA FOR MOVING PICTURES

Who has not tied something heavy on the end of a string and whirled it faster and faster? Soon it looked almost as if a circle were floating in the air. This is the discovery that set men working upon the idea of moving pictures.

Many, many people tried different ways to make action records. After men learned how to take photographs, they were well started on the way to make moving-picture records.

Men knew that thousands of different pictures taken quickly one after the other would show how people and things moved. They had found that, if these pictures could be made to move very fast as people looked at them, the people would not see them as different pictures. To those who looked at them it would seem as if the things pictured were really moving.

No one knew how to take pictures on anything but glass. So many pictures must each be very small. Some way must be found to keep them from getting out of place.

THE MOVING PICTURE IS MADE

George Eastman and another inventor, both at about the same time, found out how to use a *film* in place of glass. This film could be rolled up. It made it easy to handle many pictures that must be used quickly one after the other.

Finding a way to show these pictures took long years of hard work. Men in England, in France, and in America were trying to find how to do this. A man from Richmond, Indiana, named Fred Jenkins had been working by himself on this problem.



Photo by Harry Drucker from R. I. Nesmith and Associates

TAKING A MOTION PICTURE IN THE TROPICS



PART OF A MOVIE STRIP. NOTICE THE CHANGED POSITION OF THE MAN'S LEFT HAND, AND THAT EACH PICTURE IS ALMOST, BUT NOT QUITE, LIKE THOSE NEXT TO IT.

You have all made shadow pictures on the wall. Jenkins' machine worked somewhat like a person making shadow pictures. Jenkins used an electric light. He sent the light through the film in front of it. The film was like a long ribbon made of pictures. It moved along quickly. Jenkins had hung a white sheet on the wall. The picture showed on the sheet. This film was called "Annabelle, the Dancer." It looked as if the dancer were really there. This was the first moving-picture show that people ever saw. It was in 1894. How long ago was that?

Eastman, Jenkins, and many others have given us the "movies" of today. Think of the hours of happiness people have had at the movies. Think of seeing almost the whole world as it lives and moves. Those who cannot travel can learn much about people in other lands as they watch their actions. They can learn still more from the stories on the film. People can now take moving pictures with their own moving-picture cameras. They can make action records that they can look at over and over again.

TALKING PICTURES

No sooner had people learned that pictures could show things as they really happened than inventors were again at work. They wished to add the talking and other sounds that went with the actions. So

many improvements had by this time been made in other electrical machines that it seemed as if this might come to be.

The great telegraph and telephone companies pay inventors to work for them all of the time. Some of the men working for these companies found ways of having the sounds heard while people were seeing the actions on the screen. At the same time they found a way to show pictures that are not shadow pictures. These pictures are clearer and better than shadow pictures.

Men have learned now how to show colored action pictures that seem to be almost alive. We can hear, as well as see, things happen on the screen. We can imagine that we are looking at real people while they do real things.

Not only does this give us pleasure, but it teaches us how things happened long ago; how things happen in other places; and best of all, we can keep these records and see them over and over as time goes on.

MORE TO THINK ABOUT AND DO

1. Try to look at a phonograph carefully as it runs. Can you understand how the sound you hear is made?
2. What happens when you change the speed of the record on the phonograph?
3. Can you find out how a *dictaphone* is used?

4. Think of some record you would like to have made by some one whose voice you love to hear. How could this be done?

5. When you go to a moving-picture show, try to find out more about how the pictures get to the screen.

6. If you go to a talking-picture show, perhaps the operator will let you see the different machines that are used.

7. Make a list of the words you need to remember to talk about phonographs and moving pictures.

8. Make up a play that shows how movies help children all over the world to know each other better.

9. Read the part of the story again that tells,

(a) How sound is made

(b) What the phonograph does for us

(c) About talking pictures

10. Make five questions that you can answer about speech and action records.

II. MEN TALK OVER WIRES

About sixty years ago Alexander Graham Bell was working in Boston. He had been in London and had seen the English telegraph. He had also heard about the other things people in different countries were learning about electricity. He thought he could improve the telegraph. He wished to have it make sounds instead of dots and dashes.

One day a bigger idea came to his mind. Could not

a person talk at one end of an electric wire and have some one really hear the words at the other end of the wire?

BELL TRIES TO SEND SPOKEN MESSAGES

Bell had a small workshop. He had a young man named Watson to help him. They worked more than three years to find a way to make electricity help man to talk over wires.

Like Thomas Edison, Bell had studied how sound is made. He also knew that waves of air strike our eardrums and then we hear sounds; and he knew that talking made many different kinds of air waves. No two people make just the same kind of air waves when they talk. That is why we can tell one voice from another when we hear it.

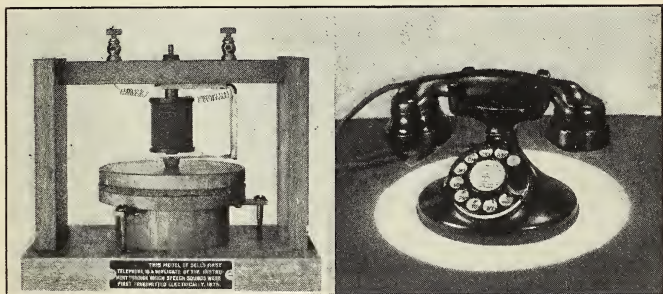
THE TELEPHONE IS INVENTED

After working hard, Bell made a machine at one end of an electric wire. It had a mouthpiece and one other part. Air waves made by a person speaking into the mouthpiece struck a thin piece of metal in the machine. The metal vibrated as the metal did in Edison's phonograph. As it vibrated, little waves of electric current went through the wire.

At the other end of the wire Bell had built another little machine. This was somewhat like the sounder in the telegraph. It did not pull the piece of metal

with a "click." Instead, the electric waves coming through the wire made the piece of metal vibrate. It vibrated just like the piece at the other end of the wire.

This vibration made air waves just like the ones that had been made by the speaker at the other end of the



Courtesy American Telephone and Telegraph Co.

THE FIRST TELEPHONE AND THE TELEPHONE OF TODAY

wire. These waves came to Mr. Watson's ear one day. He heard Mr. Bell say, "Mr. Watson, please come here. I want you." The *telephone* had now been invented by Alexander Graham Bell. Others who had worked before he had begun to work on it had helped Bell to make a telephone.

THE EARLY DAYS OF THE TELEPHONE

The telephones we have today do not look much like the one Mr. Bell and Mr. Watson had. Now, the

transmitter, or mouthpiece, and the *receiver*, or hearing part, are fastened together, one at each end of an electric circuit so that talking and hearing can both be done at each end of the line.

In 1892 the cities of Chicago and New York were connected by telephone. In 1915 Dr. Bell sat in New York City and Thomas A. Watson sat in San Francisco. The two men were half a week's journey apart by a fast train. They talked easily over a long-distance telephone. How long ago did they do this?

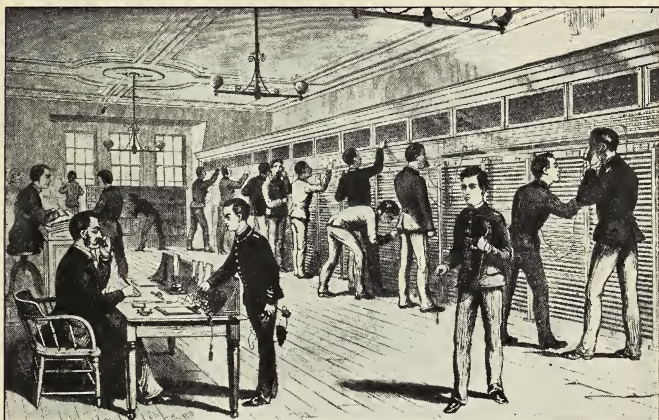
TELEPHONE SERVICE

When you take up a telephone receiver, it makes an electric circuit with a central switchboard operator. Then the operator says, "Number, please?" When she has the number, she makes an electric connection between your line and the line you will need to use. When you finish talking, she breaks the connection.

Telephone switchboards are somewhat like the great train yards at union depots. Telephone lines come into them from all the places that are listed in the telephone directory. In a small village every telephone is connected to one switchboard. Then one operator can answer all calls. Sometimes people call this operator "central."

Switchboard operators work as fast as they can to

make connections, to answer questions, and to break the connections when the people have finished talking. We can help these operators very much if we do a few things very carefully.



Courtesy American Telephone and Telegraph Co.

THE TELEPHONE EXCHANGE OF NEW YORK CITY IN 1879

HELPING THE TELEPHONE OPERATORS

We should look in the telephone directory to be certain of the telephone numbers that we wish to call. We may not have remembered them correctly. We should not forget that often other people are waiting to use the telephone line we are using. We should not take up the telephone receiver unless we wish to talk over the line. We should speak clearly but

not too loudly into the transmitter. We should be very careful to put down the receiver when we have finished speaking.

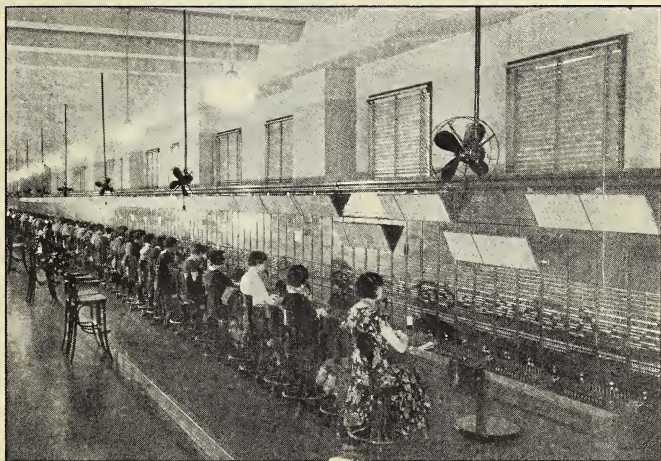
TELEPHONE SYSTEMS

In large cities there are different switchboards for different parts of the city. Often these switchboards are in a long row with an operator sitting in front of each one. This is called a *telephone exchange*. Each operator takes the calls for her part of the city. She makes the connection if a person wishes to talk over some other line on her switchboard.

If a call is for another part of the city, the operator calls that switchboard operator. Before we can tell it, the connection between the two switchboards is made and the people can talk to each other. This connection is made over a line that connects all the switchboards with each other.

Many cities today have *dial*, or *automatic*, telephones. Persons using these do not have to tell "central" what number they want. Instead, they show this by moving a round plate on the telephone, on which are printed the letters and numbers showing the telephone with which they wish to be connected. These machines cannot be described in simple language. Few people except the inventors fully understand just why they work as they do.

We have seen how the switchboards in one city are joined together into a system. In this same way all of our cities are connected by telephone lines from one city to another. There are some very large telephone systems in most countries just as there are large railroad



Courtesy American Telephone and Telegraph Co.

A MODERN SWITCHBOARD

systems. The American Telephone and Telegraph Company is one of the very large companies that is made up of many smaller lines. When the telephones in many different places are managed by one company, each user of a telephone can reach a very large number of other users.

THE TELEPHONE AND COMMUNICATION

Long-distance telephone lines go in every direction between the cities and towns of our country. They are used almost as much in many other countries. It is possible to talk across the whole length of our country today for less money than it used to cost to send a letter halfway across the country by the Pony Express.

Business that once took weeks of time to do can now be done over the telephone or telegraph in a few minutes. The telephone saves time. It saves going on errands in hotels, in offices, on ships, and in schools. Think of other places where the telephone saves steps.

The different people in one family can talk to each other from different places. In sickness, the telephone brings the doctor. It brings help if there is a fire or any other trouble anywhere. It brings the policeman or constable if some one has done wrong. It helps the newspaper reporter to gather news.

These are some of the things the telephone does in parts of the country where people live quite near together.

In the places where people live far apart the telephone has perhaps done its greatest good. It has made them able to talk to other people whenever they needed to do so. Many times the people who work in the mountains or in the deep woods have no other way of letting others know their needs.

It is hard to imagine what it would be like to have our friends go away to a new part of the country to live as people used to do. Sometimes they never heard from each other after they once said, "Goodby." Now we may get postal cards, letters, telegrams, cablegrams, or radiograms from anyone who is away from home. If we wish to do so, we can talk to almost anyone over a long-distance telephone. If the person desired has no telephone, we can pay a small sum of money and he or she will be told by a messenger to come to the nearest telephone.

THE WIRELESS TELEPHONE

After Marconi had invented the wireless telegraph, men were sure they could soon find a way to make a wireless telephone. We have it today. In 1927 the first wireless telephone was opened between New York and London. Now it is as easy to talk to ships at sea as it was a few years ago to send them wireless telegrams.

The pilot of a large passenger airplane is likely to be connected by *radiophone*, or wireless telephone, with his landing stations. There are radio-telephone stations in many different countries now. These may be connected with our home and office telephones. People can talk by this means to other people in lands as far away from us as Australia.

THE EARLY RADIOS

You remember that people for years had tried to learn to fly. By working and playing for a long time with the wireless telephone people learned to make good

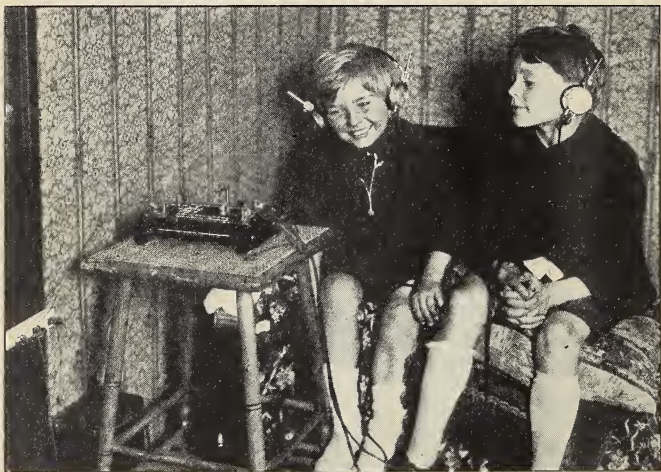


Photo from Brown Bros.

A CRYSTAL RADIO SET OF 1922

radios. Men and boys built both *sending* and *receiving radiophones*. They used *earphones* to hear each other. More than one pair of *earphones* could be connected to a *receiving set*. Then more than one person could here at the same time.

This is the way that many people sitting in their homes on the evening of Election Day in November,

1924, heard that Calvin Coolidge was to be the next President of the United States. How long did it take the people of California to get news from Washington, D. C., in 1861?

LATER RADIOS AND BROADCASTING

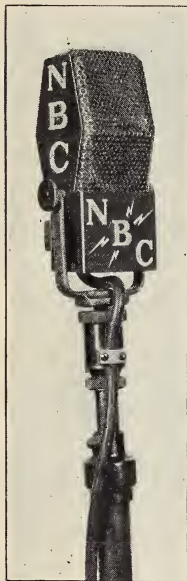
As soon as people began to want to have radio telephones in their homes, there were other improvements needed. One of these was a *loud speaker*. Then the earphones would not be needed. Any number of people in the room could then hear what was said over the radio.

Inventors had learned more about using electricity to make sound waves. They were able to make a loud speaker. Most radios now have the loud speaker built into the radio. In what other places are loud speakers now used?

A *broadcasting station* makes a business of sending wireless-telephone, or radio, messages to all who wish to listen. KDKA, at Pittsburgh, was the first broadcasting station to be built in our country. Soon different companies were each trying to make the very best broadcasts that could be made. They learned how to make a better *microphone*. The microphone came from the idea of the transmitter in the telephone. Broadcasting is now a regular kind of work that people study hard to learn how to do well.

RADIO MAKES THE WORLD ONE FAMILY

Many people who could not go to large meetings held in far-away places wished to hear the speeches as they were given at these meetings. You remember how much the people of California wished to know what Lincoln said in 1861.



Courtesy American Telephone and Telegraph Co.

THE LATEST TYPE
OF RADIO MICRO-
PHONE

Then thinking persons found a way to put a microphone in front of a speaker as he talked. Word is sent to newspapers when any speech that many would like to hear is to be given. The newspapers tell the people about the time and the *radio station* that will send out the speech. Then anyone who has a radio can *tune in* and hear the speech.

There are over six hundred broadcasting stations in our country alone. There are more stations in the United States than there are in other countries. Perhaps this will not be true for very long. The *broadcasting studios* are very carefully built so as to have the sound waves as nearly perfect

as they can be made. What do you think will be the next improvement made in the radio?

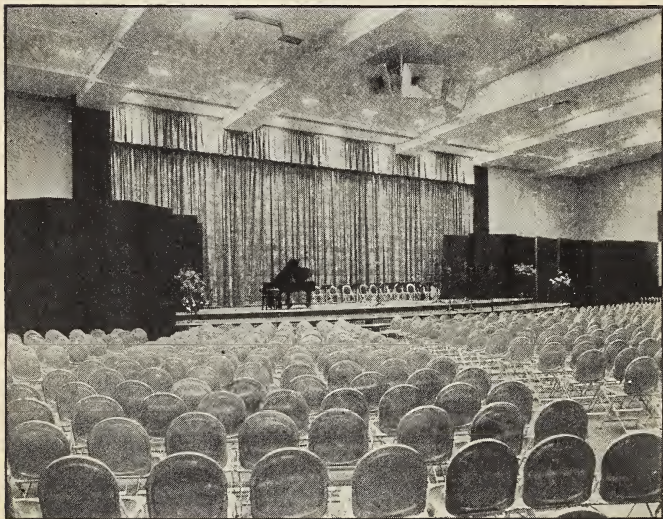
There are radios now on ships, on railroad trains, in airplanes, and in automobiles. There are radios in offices, schools, homes, hospitals, and churches. There are radios nearly everywhere that people have heard about them. Business men pay for broadcasting time to advertise what they have to sell. It is said that the ladies of Japan can buy parasols with radios in the handles. In some countries there are *pocket radios* not much larger than this book.

Not only do people listen to speeches over the radio, but they listen to many other things. Beautiful music is often heard. Sometimes phonograph records are used to give us radio music. Much of the music we hear, however, is being played or sung as we listen to it. Men and women tell many things over the radio that would be hard to find in books or magazines. Newspaper offices tell short news stories over the radio. *Radio programs* are given by different countries for each other. Perhaps one of the most helpful services given by the radio is the daily weather report. Why is this so helpful?

SOON WE MAY SEE AS WELL AS HEAR BY RADIO

Newspapers get a large part of their news over the telephone. One of the new kinds of communication that they use is *television*. This long word means seeing by means of pictures sent by radio. Inventors made

a machine to do this by putting together what they knew about light, radio, and photography. By using this way of sending picture news, people can see how things happen as they read the news.



Courtesy American Telephone and Telegraph Co.

THE WORLD'S LARGEST BROADCASTING ROOM IN RADIO CITY, NEW YORK

We believe that the most wonderful uses of radio are yet to come. In many places in the world today inventors are studying how to make radio do something else for us. They are finding the way to make

the radio give us colored moving pictures of people while they are in front of the microphone broadcasting for us.

Perhaps some day you will sit at home and see a baseball game while it is being played a thousand miles away. People think it will not be very long before radios will be made that let us see as well as hear those who are broadcasting.

It is hard to tell what changes television will make in the ways boys and girls will study about other lands and peoples. It is hard to say what television may make you wish to do outside of school hours. Can you think of some of the things you may like to do when you can see and hear around the world?

FROM LONG AGO TO TOMORROW

In this book we began by thinking about the way we do things today. We then went back to the days of very, very long ago. We have seen how man began with only his two hands to get the best things he could for his family and for himself.

We have studied how he first carried his goods and how he learned to talk to others. At that time these were two quite different things to do. As time went on, transportation became better because communication was being carried on more and more.

Today transportation and communication each help

the other in so many ways that neither can go on alone. Safety of transportation comes from the improved ways of communicating. Quick ways of communication would not be helpful if there were not quick ways of sending goods. Both of these two great helps man has made for himself by trying to find better and better ways of using nature's gifts. Man is still moving forward into a bigger and better tomorrow.

MORE TO THINK ABOUT AND DO

1. Try to understand the different parts of the telephone the next time you use one.

2. Make a list of the things that can be done over the telephone that people long ago did in other ways.

3. Try to see a telephone switchboard. You may be able to learn how to operate one.

4. If you can use a radio, try to learn how to find the stations you like. Try to tune in very carefully so that you get soft clear sounds.

5. If you can visit a radio repair shop, you will find out much more about the way the radio works.

6. In what ways does the radio help you with your school work? In what ways does it add to your enjoyment?

7. Write a short talk to broadcast over a make-believe radio. Be sure to speak so that your *radio audience* can understand you.

8. Try to watch for the stories of improvements in the radio as they are told in newspapers.

APPENDIX

SUGGESTED LIBRARY READINGS

UNIT ONE—TRANSPORTATION TODAY AND VERY LONG AGO

II. The Beginnings of Transportation

How the World Grew Up by Grace Kiner — Follett

The Later Cave Men by Katharine E. Dopp — Rand McNally

III. How Man Improved Carrying by Hand

Travel by Air, Land, and Sea by Hanson Webster —
Houghton Mifflin

Pages 313-319, "Moving Goods without Animals"

UNIT TWO — HOW MAN FOUND OTHER BURDEN BEARERS

I. The First Boats

The Cave Boy of the Age of Stone by Margaret McIntyre
— Appleton-Century

The Early Sea People by Katharine E. Dopp — Rand McNally

II. Animals as Burden Bearers

Our Little Friends of the Arabian Desert by Frances Carpenter — American Book

Cave, Mound, and Lake Dwellers by Florence Holbrook
— Heath

Taming the Animals by W. L. Nida — Laidlaw

Travel by Air, Land, and Sea by Hanson Webster —
Houghton Mifflin

Pages 299-311, "Vehicles That Have No Wheels"

Pages 339-355, "Unusual Beasts of Burden"

UNIT THREE — EARLY MAN'S GREATEST INVENTION

I. The Wheel

Around the World with the Children by Frank Carpenter — American Book

The Ways We Travel by Frances Carpenter — American Book

Pages 43-55, "Over Ice and Snow"

Pages 56-67, "Our Friend, the Horse"

II. More about Wheels

Pioneers by Wright, Tirey, and Crites — Johnson

Pages 10-20, "Little America"

Pages 20-30, "A Husky in Little America"

Overland in a Covered Wagon by Joaquin Miller — Appleton-Century

Travel by Air, Land, and Sea by Hanson Webster — Houghton Mifflin

Pages 271-298, "Long Ago and Far Away"

Adventuring in Young America by McGuire and Phillips — Macmillan

Pages 189-205, "Travel, Transportation, and Communication in Colonial Days"

Pages 303-315, "Travel, Transportation, and Communication in Pioneer Times"

Stories of Useful Inventions by S. E. Forman — Appleton-Century

Pages 144-155, "The Carriage"

UNIT FOUR — MAN USES THE WATERWAYS

I. Bigger and Better Boats

How the Present Came from the Past, Book One, by Margaret Wells — Macmillan

America's Heritage from the Long Ago by Wickham and Phillips — Macmillan

Pages 1-83, "How Early People Lived"

The Ship Book by Dukelow and Webster — Houghton Mifflin

Pages 123-142, "The First Boats"

Pages 143-153, "Early Traders"

The Story of Long Ago by Southworth and Southworth — Iroquois

Pages 156-164, "The Phoenicians"

II. Sailing the Seas

The Ship Book by Dukelow and Webster — Houghton Mifflin

Pages 43-49, "Sailing Ships"

Pages 56-63, "Boats for Play"

Pages 147-220, "Ships of Traders and Explorers"

Pathfinders by Land and Sea by Elmer Green — World Book

Finding America by Smallidge and Paxson — Houghton Mifflin

Travel by Air, Land, and Sea by Hanson Webster — Houghton Mifflin

Pages 411-429, "Ships of Other Days"

Full Steam Ahead by H. B. Lent — Macmillan

UNIT FIVE — STEAM MULTIPLIES TRANSPORTATION

I. Iron Horses Draw Loads on Land

The Ways We Travel by Frances Carpenter — American Book

Pages 78-94, "The Iron Horse"

Pages 95-118, "On a Fast Express"

Building Our Country by McGuire and Phillips — Macmillan

Pages 107-115, "Travel and Transportation in the Fifties"

Explorers and Pioneers by W. L. Nida — Macmillan

Pages 469-492, "How the Explorers Traveled"

Travelers and Traveling by Eva M. Tappan — Houghton Mifflin

Pages 26-35, "How Refrigeration Brings Us Food"

Pages 108-120, "About Roads and Bridges"

Travel by Air, Land, and Sea by Hanson Webster — Houghton Mifflin

Pages 100-188, "About Railroads"

How We Travel by J. F. Chamberlain — Macmillan

Pages 31-45, "Traveling by Train"

Thinkers and Doers by Floyd Darrow — Silver Burdett

Pages 213-223, "The Magic of a Breath of Air"

Modern World Setting for American History by Jones and Sleman — Heath

Pages 92-101, "George Stephenson"

How the World Rides by Florence Fox — Scribner's

Pages 30-51, "The Railway Train"

The Children's Book of Celebrated Bridges by Lorenda Bryant — Appleton-Century

Stories of Useful Inventions by S. E. Forman — Appleton-Century

Pages 54-72, "The Steam Engine"

Pages 156-163, "The Carriage"

Clear Track Ahead! by H. B. Lent — Macmillan

II. Steamships Carry Goods across Oceans

Explorers and Pioneers by W. L. Nida — Macmillan

Pages 443-441, "The First Steamboat on Western Rivers"

Pages 457-468, "Steamboats on the Lakes"

Travel by Air, Land, and Sea by Hanson Webster —
Houghton Mifflin

Pages 259-270, "Tunnels and Ferries"

Pages 390-410, "Passenger Lines and Freight Ships"

The Ship Book by Dukelow and Webster — Houghton
Mifflin

Pages 1-19, "The Liner, She's a Lady"

Pages 20-42, "Ships That Work"

Pages 221-274, "The Story of Steam Ships"

Stories of Useful Inventions by S. E. Forman — Apple-
ton-Century

Pages 166-186, "The Boat"

Stories of American Pioneers by Heard and King —
Winston

Pages 136-150, "The First Steamboat"

UNIT SIX — WAYS AND MEANS FOR SHIPS AND TRAINS

I. Ocean Ports and Ocean Paths

A Train, a Boat, and an Island by Charlotte Kuh —
Macmillan

Sailing the Seas by Baldwin and Livengood — Ameri-
can Book

Travel by Air, Land, and Sea by Hanson Webster —
Houghton Mifflin

Pages 356-367, "We Visit a Busy Harbor"

Pages 368-389, "Rivers Made by Man"

Full Steam Ahead! by H. B. Lent — Macmillan

II. Inland Routes by Water and by Rail

How the World Rides by Florence Fox — Scribner's

Pages 119-143, "Boats and Waterways"

Explorers and Pioneers by W. L. Nida — Macmillan

Pages 443-456, "The Erie Canal"

Pages 582-588, "The Union Pacific and Central
Pacific Railroads"

Travelers and Traveling by Eva M. Tappan — Houghton Mifflin

Pages 36-43, "How Freight and Express Are Managed"

Pages 82-94, "Transportation by Rivers and Canals"

The Wonderful Locomotive by Cornelia Meigs — Macmillan

American Inventions and Inventors by William and Arthur Mowry — Silver Burdett

Pages 183-244, "Travel"

Stories of American Pioneers by Heard and King — Winston

Pages 239-260, "Development of Railroads"

The Growth of Our Country by Burnham and Jack — Winston

Pages 55-75, "Changing Ways of Working"

Pages 76-93, "Pioneers of the Middle West"

UNIT SEVEN — MAN LEARNS TO USE MORE OF NATURE'S GIFTS

I. Electricity Drives Street Cars and Trains

How We Travel by J. F. Chamberlain — Macmillan

Pages 15-22, "Travel in New York City"

Great Moments in Science by Marion F. Lansing — Doubleday Doran

Pages 189-205, "New Sources of Power"

Travelers and Traveling by Eva M. Tappan — Houghton Mifflin

Pages 45-73, "City Travel"

Seeing America by Pitkin and Hughes — Macmillan

Pages 66-90, "Transportation and Power"

II. Horseless Carriages Travel on Roads

The Romance of Modern Invention by Archibald Williams — Seeley (London)

Pages 224-257, "Horseless Carriages"

Travel by Air, Land, and Sea by Hanson Webster — Houghton Mifflin

Pages 212-231, "Bicycles, Automobiles, and People Afoot"

Pages 232-258, "Bridging the Rivers"

How the World Rides by Florence Fox — Scribner's

Pages 56-72, "The Automobile"

How We Travel by J. F. Chamberlain — Macmillan

Pages 101-106, "Automobiles"

Pages 107-110, "Bicycles"

Light Then and Now by Ida B. Lacey — Macmillan

Travelers and Traveling by Eva M. Tappan — Houghton Mifflin

Pages 74-81, "What the Motor Car Is Doing"

Great Moments in Science by Marion Lansing — Doubleday Doran

Pages 189-222, "New Sources of Power"

III. Man Learns to Fly through the Air

How They Carried the Goods by Charles G. Muller — Sears

Transportation by Jeanette Eaton — Harper

Transportation by William F. Rocheleau — Flanagan

Pages 285-312, "Navigating the Air"

How and Where We Live by Nellie B. Allen — Ginn

Pages 218-260, "An Airship Trip across Our Country"

The Picture Book of Flying by Frank Dobias — Macmillan

Air Travelers by Laura A. Large — Lothrop

Pioneers of the Air by Lila Gravatt — Mentzer Bush
Dick Byrd — Air Explorer by Fitzhugh Green — Putnam

Air Travel by James Mooney — Scribner's
Minute Epics of Flight by Winter and Degner — Grossett

We by Charles A. Lindbergh — Putnam
The Story of Aircraft by Chelsea Frasier — Crowell
The Romance of Progress by W. J. Claxton — Stokes

UNIT EIGHT — COMMUNICATION TODAY AND VERY LONG AGO

Same as Unit One and Unit Two

UNIT NINE — EARLY MAN COMMUNICATES WITH PEOPLE TOO FAR AWAY TO HEAR HIS VOICE

I. The First Messages

Inventions and Discoveries of Ancient Times by W. L. Nida — Laidlaw

Pages 52-62, "How Menes Learned to Write"

II. Man Learns His A B C's

Inventions and Discoveries of Ancient Times by W. L. Nida — Laidlaw

Pages 157-166, "The Story of the A B C's"

Pages 244-249, "The Wise Hindu and Our Arabic Numbers"

America's Heritage from the Long Ago by Wickham and Phillips — Macmillan

Pages 1-15, "How the Earth's Earliest People Lived"

Pages 17-41, "How the People of Ancient Egypt Lived"

Pages 43-59, "How the People of Babylonia Lived"

Pages 60-70, "How the People of Assyria Lived"

UNIT TEN — MAN USES WRITTEN LANGUAGE

I. The First Books

Stories of Useful Inventions by S. E. Forman — Appleton-Century

Pages 203-218, "The Book"

A Short History of Mankind by Wells and Carter — Macmillan

Pages 20-22, "The First Cities and the Invention of Writing"

Pages 46-49, "The Jews, Their Bible"

Pages 64-69, "Alexander the Great Teaches Asia and the World"

Pages 93-96, "The Teachings of Jesus and the Growth of Christianity"

America's Heritage from the Long Ago by Wickham and Phillips — Macmillan

Pages 295-304, "Religious Life of the Middle Ages"

Beginnings in the Old World by Coulomb, Dowling, and Rapp — Macmillan

Pages 118-132, "The Church in the Middle Ages"

Lord and Vassal by Arthur G. Terry — Row Peterson

Pages 25-28, "The Empire and the Church"

Pages 99-105, "Friar, Scholar, and Builder"

Elementary World History by Beard and Bagley — Macmillan

Pages 103-121, "The Middle Ages: Princes, Priests, and Peasants"

Pages 253-258, "Life in the Monastery; Books"

The Story of Long Ago by Southworth and Southworth — Iroquois

Pages 118-119, 131, "Writing"

Page 147, "The Ten Commandments"

Page 162, "The Spread of Learning"

The Enchanted Past by Jeanette Hodgdon — Ginn
Great Names and Nations by Harmon B. Niver —
Mentzer Bush

The Beginnings by Arthur Guy Terry — Row Peterson

II. Printed Records and Reports

Historic Inventions by Rupert Holland — Macrae Smith

Pages 9-41, "Gutenberg and the Printing Press"

Famous Men of the Middle Ages by Haaren and Poland
— American Book

Pages 257-262, "Gutenberg"

Pilots and Pathfinders by W. L. and Stella Nida —
Macmillan

Pages 94-99, "The Story of Printing"

Great Moments in Science by Marion Lansing —
Doubleday Doran

Pages 143-162, "More Stories of Time and Space"

Makers of Many Things by Eva M. Tappan — Hough-
ton Mifflin

Pages 25-35, "How Rags Become Paper"

Pages 36-45, "How Books Are Made"

III. Printing Multiplies Communication

Thinkers and Doers by Floyd L. Darrow—Silver Burdett

Pages 224-236, "When Typewriting Came into
Style"

The Wonder Book of Knowledge by Henry Chase Hill —
Winston

Pages 172-179, "The Story in a Newspaper"

Pages 364-372, "The Story of the Addressograph"

Pages 380-383, "The Story in Photo-Engraving"

The World about Us by Inez McFee — Macrae Smith

Pages 216-231, "The Paper Industry"

Seeing America, Book Two, by Pitkin and Hughes —
Macmillan

Pages 270-277, "A Paper Mill"

UNIT ELEVEN — WORLD-WIDE WRITTEN OR PRINTED
COMMUNICATION

I. The Carrying and Delivery of the Mails

How the World Grows Smaller by Beeby and Beeby —
Merrill

Pages 191-227, "The Mail"

Explorers and Pioneers by W. L. Nida — Macmillan

Pages 521-572, "Settlement and Communication in
the West"

II. Electricity Carries Messages

Thinkers and Doers by Floyd Darrow — Silver Burdett

Pages 133-147, "Dots and Dashes"

Stories of American Inventions by Inez McFee —
Crowell

Pages 50-73, "Morse and the Telegraph"

How the World Grows Smaller by Beeby and Beeby —
Merrill

Pages 228-259, "The Telegraph"

Makers of Progress by Nida and Nida — Heath

Pages 192-200, "Marconi and the Wireless"

UNIT TWELVE — HEARING AND SEEING AROUND THE
WORLD

I. Speech and Action Records

Stories of American Pioneers by Heard and King —
Winston

Pages 280-306, "Thomas A. Edison"

Thinkers and Doers by Floyd Darrow — Silver Bur-
dett

Pages 292-304, "Two Royal Entertainers"

Stories of American Inventions by Inez McFee —
Crowell

Pages 143-165, "How the Phonograph Was Born"

Everyday Wonders by Laura A. Large — Wilde
First Lessons in Geography by Philip A. Knowlton —
Macmillan

Pages 240-249, "How People Exchange Messages"

II. Spoken Communication Is Heard round the World

Makers of Progress by Nida and Nida — Heath

Pages 170-179, "Alexander Graham Bell"

Pages 180-190, "Edison and His Inventions"

Pages 192-206, "Marconi, Wireless and Radio"

Seeing America, Book Two, by Pitkin and Hughes —
Macmillan

Pages 287-306, "Making a Record for a Phonograph"

Pages 307-329, "Modern Radio, an Exciting Flight"

The World We Live in and How It Came to Be by Gertrude Hartman — Macmillan

Pages 283-298, "From Wires to Wireless"

How the World Grows Smaller by Beeby and Beeby —
Merrill

Pages 157-190, "The Telephone"

Thinkers and Doers by Floyd Darrow — Silver Burdett

Pages 341-354, "Through the Ether"

The Ways We Travel by Frances Carpenter — American Book

Pages 266-278, "The Story of the Telephone"

Pages 279-291, "A Radio Talk"

Pathways in Science by Craig and Johnson — Ginn

Pages 314-335, "How Sound Is Carried"

INDEX AND PRONOUNCING VOCABULARY

KEY TO PRONUNCIATION

ā, as in āle; â, as in sen'âte; â, as in câre; ă, as in ăm; ǎ, as in fi'năl; ä, as in ärm; å, as in åsk; ã, as in so'fã; ch (=tsh), as in chair; ê, as in êve; ě, as in ě-vent'; ě, as in ěnd; ě, as in re'cěnt; ě, as in fěrn; g (hard), as in go; ĩ, as in ĩce; ĩ, as in ĩll; j (=dzh), for g, as in gem; k, for ch, as in chorus; n (ordinary sound), as in no; ŋ (like ng), for n before the sound of k or hard g, as in bank; N, representing simply the nasal tone of the preceding vowel, as in ensemble (ân'sân'bl'); ò, as in òld; ô, as in ô-bey'; ô, as in ôrb; ȳ, as in ôdd; ȳ, as in cȳn-nect'; ȳ, as in sȳft; oi, as in oil; ōō, as in fȳōd; ōō, as in fȳōt; ou, as in out; s (sharp), as in so; th, as in thin; ū, as in ūse; ū, as in ū-nite', ū, as in ūrn; ū, as in ūp; ů, as in cir'cůs; ů, as in mĕ-nŭ'; z (like s sonant), as in zone.

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